

IMPLEMENTATION OF CIRCULAR ECONOMY CONCEPTS THROUGH ECO-ENZYME PRODUCTION IN THE MANAGEMENT OF FOOD LEFT WASTE IN MAMBAL VILLAGE

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Abstract:

The waste problem is a severe issue in Indonesia, including on the island of Bali, which is famous for its natural beauty. Mambal Village in Badung Regency is the focus of the Real Work Lecture-Community Empowerment by Students (KKN-PMM) program from Warmadewa University. In this program, students attempt to overcome the problem of food waste by introducing the concept of a circular economy through the production of eco-enzymes. Eco-enzymes can be made from organic waste, especially food waste. Its use follows circular economy principles by converting waste into value-added resources. Through a series of activities, including collecting raw materials, holding demonstrations on making eco-enzymes, and providing outreach to the community, the KKN-PMM program succeeded in providing a practical solution to the food waste problem in Mambal Village. Active community participation, especially among farmers, is also the key to the success of this program. The results of this program include increasing community awareness and skills in managing organic waste and creating a cleaner, healthier and more sustainable environment. Apart from that, this program also integrates various fields of science, such as law, health, engineering, administration and economics, to improve prosperity and sustainability at the local level. Thus, the KKN-PMM program in Mambal Village is a concrete example of applying the circular economy concept to overcoming environmental problems. Through collaboration between students and the local community, this program provides practical benefits and creates harmonious and mutually beneficial relationships. The hope is that this effort can inspire other regions to face similar challenges in waste management, which is in line with circular economy principles that minimize waste and maximize resource utilization.

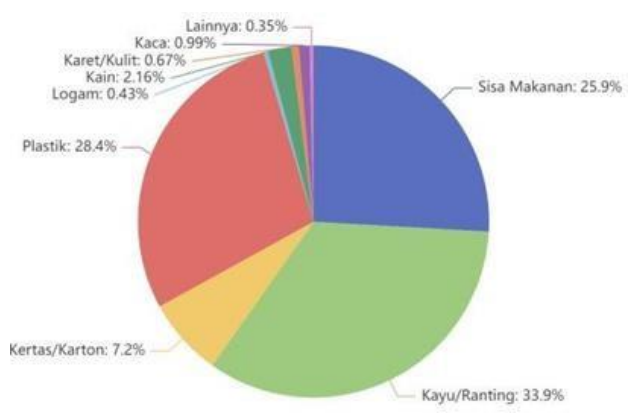
INTRODUCTION

The waste problem in Indonesia is an increasingly urgent issue because of its detrimental impact on the environment and public health. One of the leading causes of waste problems is society's increasing amount of waste and the need for adequate waste management infrastructure. Bali, an island famous for its natural beauty, is also one of the provinces with the potential to contribute to waste. Even though it is known as an attractive tourism destination, challenges in waste management remain the focus of attention. Based on National Waste Management Information System (SIPSN) data released by the Ministry of Environment and Forestry (KLHK), total waste generation in Bali has reached a very high figure, namely around 525,962 tons per year in 2022. One of the various provinces in Bali who participated



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Badung Regency contributes to the amount of waste. Effective and sustainable waste management efforts in Badung Regency are significant to maintaining environmental cleanliness and public health.



Picture 1. Waste Composition Based on Waste Type Source: SIPSN (National et al.)

Based on National Waste Management Information System (SIPSN) data, it can be seen that the composition of waste in Badung Regency in 2022 is dominated by the top three types of waste, namely wood/twigs at 33.9%, plastic at 28.4%, and food waste at 25.9%. This can potentially threaten environmental conditions in the future, not only for humans but also for all ecosystems on earth (Dwiningsih & Harahap, 2022). One of the villages in Badung Regency is Mambal Village, where Mambal Village is also involved. Contribute to controlling the amount of waste. Mambal Village has demonstrated commitment to waste management through the implemented waste bank program. This program has succeeded in helping reduce the amount of plastic waste by involving active community participation in the waste collection and management process. However, there are still challenges in managing organic waste, especially food waste, which needs adequate attention.

Food waste is a significant component of organic waste in the waste generation in Mambal Village. Even though it has the potential to be recycled or processed into value-added products, such as coenzymes, concrete efforts have yet to be made to manage this food waste. Eco-Enzyme was introduced by Dr. Rosukon Poompanvong, founder of the Thai Organic Farming Association. The specialty of eco-enzyme lies in its ability not to require large areas of land during the fermentation process, as is required in making compost. This product does not require a composter tank with certain specifications. Used bottles of mineral water or other products that are no longer used can be reused as eco-enzyme fermentation tanks. This also aligns with the concept of reuse in a circular economy to support efforts to save the environment.

The circular economy concept also reflects sustainability principles, where the circular economy is designed to reuse leftover production goods to minimize unused waste (Manik, 2022). The transition towards implementing a circular economy certainly requires preparation in several essential aspects, including education as a medium for introducing producers, consumers and the public (Suwignyo, Patdono; Arkananta et al.; Singgih et al.; Fudhia et al.; Juniani 2021). Circular economy activities have the potential to be implemented in various sectors, including agriculture and industry, and



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Involving consumers and producers to support achieving one of the Sustainable Development targets (SDGs), namely zero waste (Arista, 2022). The circular economy model can be an option in integrated agriculture by developing innovation to increase efficiency and effectiveness, optimizing the use of resources and caring for environmental preservation to support sustainable development (Wal et al., 2021). Mambal Village has extensive and fertile agricultural land. The commodities available include Rice, sweet corn, peanuts, soybeans, large chilies, cayenne peppers, cucumbers, long bean eggplants, water henna flowers, and guitar flowers. The productivity of lowland rice farming in Subak Mambal is obtained per hectare per planting season as much as 5.04 tons (Dewi, 2017).

Seeing coenzymes' potential in processing organic waste into value-added products, Warmadewa University KKN-PMM students took the initiative to empower by providing information and practice directly to the Mambal Village community, especially to farmers. In their community service activities, students provide experience in science, technology, art, and religion to provide direction in solving problems and dealing with them appropriately. They try to overcome the problem of food waste with a sustainable approach, namely by using it as raw material for producing coenzymes, which is in line with circular economy principles. Utilizing coenzymes to manage food waste can create a cleaner, healthier and more sustainable environment in Mambal Village. Apart from that, this effort is also expected to impact the local community's economy positively.

METHODS

Warmadewa University KKN-PMM activities will be carried out for 1 (one) month from January to February 2024 at Mambal Village, Abiansemal District, Badung Regency, Bali Province. Community service is carried out through a series of stages, from observations and field visits to Mambal Village to identify the potential that can be developed and problems that must be resolved. The results of observations and discussions with the Mambal Village Perbekel raised several problems that became the focus of the Mambal Village KKN-PMM student work program. One of the solutions included in the program is community empowerment to overcome the problem of food waste by producing eco-enzymes.

RESULTS AND DISCUSSION

Universitas Warmadewa University (UNWAR) through the Directorate of Research and Community Service (DPPKM) Warmadewa University is deploying students to villages in the 2024 Student Community Empowerment-Real Work Lecture (KKN-PMM) program. This is done to provide learning experiences to students through direct involvement in discovering, recognizing, analyzing potential and solving community problems through the application of science, technology and art (science and technology). In the KKN program, Warmadewa University collaborates with several regions in Bali: Badung Regency, Abiansemal District, and Mambal Village. In this activity, 20 students from various faculties and fields of science were sent directly to the village for approximately one month to be able to optimize the potential they had in the KKN-PMM activity in Mambal Village, which was carried out within a period of 1 month, namely starting on January 29, 2024, to February 29, 2024. Community service is carried out through a series of stages, from observations and field visits to Mambal Village to identify the potential that can be developed and problems that must be resolved. The results of observations and discussions with the Mambal Village Perbekel raised several problems that became the focus of the Mambal Village KKN-PMM



student work program. One of the solutions included in the program is community empowerment to overcome the problem of food waste by producing eco-enzymes.

The KKN-PMM program in Mambal Village has achieved significant results in overcoming the problem of food waste by processing it into eco-enzymes. The program's well-planned and coordinated steps include collecting raw materials, preparing an implementation schedule, demonstrating eco-enzyme production, and providing outreach to the community.

Through these various activities, this program not only provides practical solutions to environmental problems but also increases the skills and awareness of the Mambal Village community in managing organic waste. The collaboration between students and the local community also creates a harmonious and mutually beneficial relationship.

Thus, this program positively impacts the reduction of organic waste and the improvement of community welfare, and it becomes an example of similar efforts in other regions that face similar problems.



Picture 2. Search for and prepare materials that will be used for the Eco-Enzyme Extension Program

The first step in implementing the program is collecting raw materials from food waste found around Mambal Village. After successfully collecting raw materials from food waste scattered around Mambal Village, including in traditional markets and households, the next step taken by KKN-PMM students was to prepare an implementation schedule with the farmers in the village. This marks their commitment to designing programs carefully and collaborating directly with relevant parties in the community, thereby ensuring success and maximum impact from every step taken.



Picture 3. Demonstrate the manufacture of eco-enzyme

In the advanced stage, KKN-PMM students also got involved in the Mambal Village community through direct demonstrations of making eco-enzymes. This demonstration provided knowledge and was a practical example that inspired the community to manage organic waste more productively.

The demonstration results were handed over to Kelian Subak to symbolize appreciation for the existing collaboration. Giving mementos in plant sprays indicated the students' deep gratitude to the people of Mambal Village. Through this approach, this service program upholds the values of collaboration and sustainability, aiming to not only provide concrete solutions to the problem of food waste but also increase community awareness and skills in managing waste sustainably for a better future.



Picture 4. Explaining eco-enzymes to farmers in Mambal Village

After the demonstration stage, KKN-PMM students took the next step by explaining eco-enzymes to the Mambal Village people.

In an interactive atmosphere, students hold question-and-answer sessions to clarify the concepts conveyed, ensuring that the participants will understand every detail. Students also distributed brochures to farmers containing complete information about eco-enzymes, including their benefits, tools and materials needed, and the steps for making them. These in-depth explanations provide the basis for a comprehensive understanding of the community. In contrast, the question and answer sessions allow them to deepen their knowledge and ensure clarity of concepts. This service program provides information through this approach and encourages active participation and deep understanding from the Mambal Village community. This reflects students' commitment to significantly contributing to efforts to increase awareness.

Moreover, community skills in managing waste sustainably.



Picture 5. Group photos and giving mementos to farmers in Mambal Village

The enthusiastic involvement of farmers in learning new methods to convert organic waste into more valuable resources not only creates a positive impact in reducing organic waste in village areas but also enriches the learning experience of Mambal Village KKN-PMM students. In this series of activities, students also gave an award in the form of a spray to Kelian Subak as an expression of thanks for their cooperation. The impact of implementing this program covers various aspects that are directly related to the fields of science mastered by Mambal Village KKN-PMM students. This can be seen in the following fields of science:

Law. Eco-enzyme or fertilizer producers are legally responsible for the safety and quality of the products produced, ensuring that consumers are protected and guaranteed. This shows the importance of understanding the legal aspects of agricultural and industrial practices.

Health. Transforming waste into eco-enzymes reduces waste polluting the environment and potentially reduces the risk of disease spread. This reflects a positive contribution to public health and the environment.

Technique. Education regarding the manufacture of eco-enzymes will likely improve land quality for future development and contribute to environmental stability. This underlines the importance of implementing appropriate technology in sustainable development. Administration and Governance. Fertilizers from simple ingredients can support public infrastructure development



and maintain environmental balance. This shows the role of administration and government in ensuring sustainable development.

Economy. Training on making eco-enzymes economically and efficiently provides farmers and small businesses opportunities to increase income by selling these products on the market. This emphasizes the importance of economic aspects in developing local agriculture and industry.

Thus, this program provides practical benefits for the people of Mambal Village and integrates various fields of science to improve welfare and sustainability at the local level.

CONCLUSION

The conclusion from the implementation of the KKN-PMM program in Mambal Village shows that community empowerment in overcoming the problem of food waste through eco-enzyme production has had a significant impact, which is in line with the concept of a circular economy. Well-planned steps, from collecting raw materials to outreach to the community, have turned organic waste into a resource with added value. In the context of a circular economy, this program reflects sustainability principles and efficiency in reusing production waste to minimize unused waste. By producing eco-enzymes from food waste, this program has integrated economic aspects to increase the added value of organic waste. The involvement of farmers in learning and direct practice in making eco-enzymes shows enthusiasm and commitment to supporting the implementation of a circular economy. Apart from that, giving appreciation to Kelian Subak as a representation of good cooperation indicates the importance of harmonious relations between students and the community, and in the context of a circular economy, emphasizing collaboration in building a sustainable cycle from production to reuse. Thus, this program provides practical benefits for Mambal Village and becomes an example for similar efforts in other regions that face similar challenges in managing organic waste. A sustainable and collaborative approach can create a cleaner, healthier, and more sustainable environment in Mambal Village and other areas that align with circular economy principles that minimize waste and maximize resource utilization.

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