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# Organic Waste Processing Based on A Circular Economy as an Environmentally Friendly Solution

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**Abstract**—Circular economy-based waste management is an important approach to support environmental sustainability while improving community welfare. This study aims to analyze the organic waste management system in Tegal Tugu Village, Gianyar, by highlighting the implementation of a circular economy and its impacts on the environment and society. This study was conducted using qualitative methods and a case study approach, involving direct observation and descriptive analysis of the collected data. The results show that Tegal Tugu Village's organic waste is managed through sorting, composting, and fermentation. This process produces value-added products, such as organic fertilizer and biogas, which not only support sustainable agriculture but also reduce dependence on chemical fertilizers. Furthermore, the implementation of a circular economy in this village provides real economic benefits, including new business opportunities and job creation for the local community. However, some challenges must be overcome, such as the limited capacity of processing facilities and the level of community awareness that is not yet fully evenly distributed in sorting waste. Overall, this study contributes by offering a circular economy-based waste management model that is relevant to be applied in other areas. The implications of these findings include improving environmental quality, empowering communities, and developing a sustainable local economy. With consistent education and strengthening of infrastructure, Tegal Tugu Village can become a model for environmentally friendly and community-based organic waste management.

**Keywords:** circular economy; green accounting; tegal tugu village; waste management

# Introduction

As the largest archipelagic country with more than 260 million people, Indonesia faces serious waste management challenges. Rapid economic growth and changes in people's consumption patterns are the main factors in the increasing amount of waste produced every day. According to data from the Ministry of Environment and Forestry Khan et al. (2021), Indonesia produces around 26 million tons of waste per year, with the proportion of organic waste covering more than 50%. Most of this waste is disposed of without adequate processing, adding to the increasing burden of environmental pollution. Increasingly limited natural resources and the lack of infrastructure to manage waste in urban areas also exacerbate this situation, creating a waste management crisis that is increasingly difficult to overcome (Díaz-Gil, 2024).

The problem of waste management in Indonesia is not only related to the increasing volume of waste but also to the increasingly complex types of waste (Saputra et al., 2021). Plastic, organic, and electronic waste require different handling, and their management is often not integrated. Saputra (2023) stated that even though there are waste management policies that have been implemented, most large cities in Indonesia still face difficulties in effective waste management. On the other hand, low public awareness of the importance of good waste management also makes the situation worse. In many cases, the waste produced is not properly sorted, and the existing collection and processing systems are often inadequate. For example, in some areas, improper management of organic waste can have adverse impacts on human health and the environment, including air and water pollution (Chowdhury et al., 2021).

Facing these challenges, circular economy-based waste management is starting to gain attention. This approach aims to reduce waste through the principles of reuse, recycling, and reducing excessive natural resources (Saputra & Paranoan, 2024). Fohler et al. (2024) stated that a circular economy can change the paradigm of waste management from a linear (throw away and buy) to a more sustainable cycle. In the context of organic waste management, this concept offers a solution that can reduce the amount of waste disposed of in landfills (TPA), as well as create value-added products such as compost and bioenergy. In addition, the use of technology to recycle organic waste into renewable energy can also help meet local energy needs, which are increasingly urgent amidst limited natural resources (Kruczek et al., 2024).

Although the circular economy offers great potential in managing waste, its application at the village level is still limited. Most existing research still focuses on waste management in big cities or industries, while villages that have great potential in managing organic waste have not received much attention. In fact, according to Priliandani et al. (2020), villages such as Tegal Tugu Village in Gianyar District, Gianyar Regency, can be an example of an effective application of a circular economy. In this village, the majority of waste produced is organic waste, such as food scraps and leaves, which if managed properly, can be converted into compost for agriculture or bioenergy for household needs. Although there have been several efforts to reduce waste, such as training in making compost on a household scale, waste management is still not optimal. Therefore, further research is needed on the application of the circular economy concept at the village level to identify existing obstacles and potentials (Pender et al., 2024).

More efficient waste management at the village level will not only reduce the negative impact of waste on the environment but can also provide economic benefits. According to a study by Belaud et al. (2019), circular economy-based waste management can create new economic opportunities, such as the production of high-quality compost for the local agricultural sector and bioenergy for village energy needs. By utilizing waste as a resource, villages can reduce their dependence on increasingly limited natural resources, while reducing carbon emissions and pollution (Chowdhury et al., 2021). The implementation of a circular economy can also reduce the burden of pollution due to poorly managed waste, such as methane gas produced from the decomposition of organic waste in landfills (Velenturf & Purnell, 2021).

The success of circular economy-based waste management requires strong support from various parties, including the government, community, and private sector. This collaboration is needed to provide adequate facilities, as well as ensure an effective and sustainable management system. Marsh et al. (2022) emphasized that the success of a circular economy depends on the ability of citizens to change their behavior in managing waste. Therefore, it is necessary to increase public awareness of the importance of environmentally friendly waste management, as well as counseling on ways to reduce, recycle, and reuse waste efficiently.

This model has the potential to be a more sustainable and economical solution in Tegal Tugu Village in overcoming the waste problem, as well as improving the quality of the environment and the welfare of the villagers. The implementation of a circular economy at the village level can also be part of a larger effort to realize sustainable development in Indonesia, under the sustainable development goals mandated by the United Nations. In this context, sustainable waste management through a circular economy approach can play a very important role in preserving the environment and improving the quality of life of residents.

# Literature Review

The study of waste management has become a frequently discussed topic and is not something new. Research in this field has been conducted for the past few years. In general, research related to waste, especially household waste, focuses on various aspects that delve deeper into how good waste processing is carried out, such as integrated waste management planning, waste bank management, case studies of waste processing implementation in an area in Bandar Lampung, design of a waste processing system for integrated waste, waste processing based on a circular economy (Pender et al., 2024; Singh et al., 2022). These studies emphasize the importance of holistic waste management through strategic planning, technological innovation, and collaboration between the government, private sector, and citizens to create an efficient, environmentally friendly, and value-added system.

## Waste

Waste is defined as the remains of human daily activities and part of the formation of natural processes according to Law of the Republic of Indonesia Number 18 (Ministry of Health of the Republic of Indonesia, 2008). According to Law Number 18 of 2008 concerning waste, it is defined that waste management is a systematic, comprehensive, and continuous activity that includes reducing and handling waste that aims to improve public health and environmental quality and make waste a resource. Waste is solid material that is no longer used and comes from various human activities, such as household activities, agriculture, offices, industrial waste, and construction waste such as debris and scrap metal. Although waste comes from various sources, most of the waste produced comes from household activities (Bagheri et al., 2021).

Waste can be categorized into three main types based on its nature and ability to decompose naturally (Nettles et al., 2024), namely:

Organic waste (wet waste), which is waste that comes from living things, such as leaves, kitchen waste, leftover food, and waste from restaurants. This waste can decompose or rot naturally within a certain time.

Inorganic waste (dry waste), is waste that cannot be degraded naturally, such as plastic, rubber, metal, cans, and glass. This type of waste takes a very long time to decompose or even does not decompose at all, causing problems in its management.

Hazardous waste is waste that has the potential to harm human health and the environment if not managed properly. This waste often contains toxic or hazardous

chemicals that require special handling, such as medical waste, batteries, and pesticides.

### Waste Processing Concept

Waste management includes various activities aimed at handling waste problems from the initial stage, namely the emergence of waste, to the final stage in the form of waste disposal or processing. Based on Article 22 of the Republic of Indonesia Law Number 18 of 2008 concerning Waste Management (Karnawijaya et al., 2022), household waste management involves several main steps:

Sorting, which is the process of grouping and separating waste based on type, quantity, and nature to facilitate further handling.

Collection, in the form of taking and moving the waste from its source to a temporary storage area or integrated waste processing facility.

Transportation, namely moving waste from the source or temporary storage location to the processing location or final processing location.

Processing, in the form of efforts to change the characteristics, composition, or quantity of waste to minimize its impact on the environment.

Final processing, which includes returning residues from previous processing to the environment in a safe and responsible manner.

This process is designed to reduce the negative impact of waste on the environment and support the sustainability of efficient waste management.

Final Processing, which is the last stage in waste management focuses on returning waste or residue from previous processing to the environment in a safe manner. The purpose of this final processing is to ensure that the processed waste does not pose a danger to the ecosystem and human health.

### Circular Economy Concept

The circular economy is an economic system or model that aims to encourage growth by maintaining the value of products, materials, and resources in the economy for as long as possible so that the negative social and environmental impacts of implementing a linear economic model can be minimized (Arruda et al., 2021). This concept is the antithesis of the traditional production economic model that only focuses on economic growth, without considering the long-term impacts, where excessive exploitation of resources and accumulation of waste continue to occur (Suchek et al., 2021).

The basic principle of the circular economy is to change the paradigm of economic sustainability from a linear model that focuses on the take-process-dispose pattern *(take-produce-dispose into waste* ) to a take-produce-reprocess-reuse pattern. Thus, the waste produced can be minimized. The application of a circular economy aims to prevent excessive exploitation of natural resources and maximize the use of energy and materials through the recycling process (Velenturf & Purnell, 2021). This approach also involves the integration of various economic actors, from the micro to the macro level, to implement the principles of a circular economy comprehensively (Manurung et al., 2022).

## Method

This study uses a qualitative method with a case study approach to examine in depth

various relevant aspects. A descriptive approach is applied to analyze the observed conditions in detail without manipulation (Saputra et al., 2022). The study was conducted in Tegal Tugu Village, Gianyar District, Gianyar Regency, Bali Province, with data obtained through direct observation of the organic waste management process in the village.

Qualitative methods focus on an in-depth understanding of a particular phenomenon through the collection of descriptive data, such as interviews, observations, and documentation. Case studies are used to explore in detail a phenomenon or problem in a particular context, with a concentration on a specific location or subject. The descriptive approach aims to accurately describe the state or condition of the research object as it is, providing a detailed and comprehensive picture of the phenomenon being studied (Burch, 2021).

The main data in this study were collected through in-depth interviews with the village government, namely, Mr. I Made Subawa the Head of Tegal Tugu Village. This interview aims to obtain detailed information about the village government's policies related to waste management, especially organic waste, and the role they see in implementing the principles of a circular economy. In addition, the interview will also identify the obstacles faced by the village government in implementing the circular economy business model, as well as opportunities that can be utilized to increase the effectiveness of waste management.

The interview process was conducted in a semi-structured manner, where the researcher prepared a series of main questions related to the implementation of the circular economy, but still gave space for the informants to develop answers more flexibly. This technique allowed the researcher to gain a more holistic and contextual understanding of the views and experiences of the village government related to organic waste management. In addition, this interview also aimed to explore the policies or regulations that have been implemented by the village government to encourage residents to participate in waste management more sustainably.

# Results And Discussion

## Profile of Tegal Tugu Village and Organic Waste Management

Tegal Tugu Village is located in Gianyar District, Bali, and is inhabited by around 2,000 people, most of whom work as farmers and craftsmen. The existence of this village is influenced by the rapid development of the tourism sector in the surrounding area, which also increases the population and economic activity. This growth brings various challenges, one of which is the increasing volume of organic waste produced, such as food scraps and leaves. Organic waste that is not managed properly can cause soil and water pollution and disrupt the health of residents. Therefore, the village government is aware of the need for a more effective and sustainable waste management strategy to prevent further environmental damage in the future.

Organic waste management in Tegal Tugu Village is carried out through the process of sorting, composting, and fermentation. Waste sorting is carried out at the household level to separate organic waste from inorganic waste. After sorting, the organic waste is taken to a processing facility for further processing. In the composting stage, organic waste such as food scraps and leaves is processed into high-quality compost. This compost is very beneficial for the local agricultural sector because it can increase soil fertility and agricultural yields. In addition, the fermentation process is also applied to convert organic waste into biogas, which can be used as an alternative energy source for the village community.

Through the implementation of this sorting, composting, and fermentation method, Tegal Tugu Village is not only able to reduce the volume of waste disposed of in the final disposal site (TPA) but also provides economic benefits for the villagers. With educational programs on the importance of good waste management, villagers are expected to be more actively involved in maintaining environmental cleanliness. This initiative is in line with the principle of a circular economy which aims to minimize waste and maximize the use of resources. Thus, the

management of organic waste in this village can be an inspiring example for other areas in creating sustainable waste management solutions that are beneficial to the environment and villagers (Partelow & Nelson, 2020).

## Results of Interview with Tegal Tugu Village Government

Interviews conducted with the Tegal Tugu village government provided in-depth insights into the implementation of the circular economy model in organic waste management that began in the last few years. As a village located in Gianyar District, Bali, Tegal Tugu Village faces significant challenges related to waste management due to population growth and the development of the tourism sector. The Head of Tegal Tugu Village, I Made Subawa, said that the main goal of implementing this circular economy is to create more efficient and environmentally friendly waste management. In the interview, he said"

> *"We are trying to change the way villagers view waste. Organic waste produced by households must be separated and managed properly."*

This reflects the increasing awareness among residents about the importance of waste sorting and management. Villagers have started implementing a system of sorting organic and inorganic waste. Organic waste, such as food scraps and garden waste, is collected separately and channeled to the local waste processing site (TPS). The Village Head also added,

> *"We have a training program to educate residents on how to manage organic waste,"*

The organic waste processing process is carried out through composting and fermentation methods, which produce compost and biogas. The compost is used to support local agriculture, while biogas is used as an alternative energy source for several households. Tegal Tugu Village residents also showed active participation in the waste bank program that has been implemented. I Made Subawa stated,

> *"With the existence of a waste bank, we hope that residents can learn to sort and process organic waste. This is not only about cleanliness but also about creating new economic opportunities."*

Through this initiative, Tegal Tugu Village residents are encouraged to be more aware of the importance of sorting organic waste, such as food scraps and leaves, which can be processed into compost and biogas. Thus, this program not only helps reduce the amount of waste disposed of in landfills (TPA) but also provides economic benefits for residents through increased agricultural yields and the provision of alternative energy sources. The involvement of residents in managing organic waste is an important step in creating a cleaner and more sustainable environment in Tegal Tugu Village. In the interview, I Made Subawa also explained the challenges faced in waste management:

> *"Our waste processing capacity is still limited. We need further support to upgrade the facilities to handle the increasing volume of waste."*

This shows that despite progress in waste management, there is still a need to strengthen village infrastructure. The improvement of Tegal Tugu Village's infrastructure is partly achieved through collaboration with other sectors to support the sustainability of this system. By implementing the principles of a circular economy, Tegal Tugu Village has the potential to become a model for environmentally friendly waste management that is beneficial to villagers.

## Organic Waste Management System in Tegal Tugu Village

The organic waste management system in Tegal Tugu Village is carried out through systematic waste separation, collection, and processing. Separation is carried out at the household level, where residents are taught to separate organic from inorganic waste. According to

Chowdhury et al. (2021), proper separation can reduce the workload of waste processors and improve the quality of processed products. With the training conducted by the village government, residents began to understand the importance of sorting waste from its source.

Organic waste collection is carried out regularly and on schedule to ensure that the waste does not accumulate in the surrounding environment. After being collected, organic waste is taken to the waste processing site (TPS) in Tegal Tugu Village. At the TPS, the processing process is carried out using environmentally friendly composting and fermentation methods. This process produces high-quality compost fertilizer that can be used by local farmers to increase their agricultural output (Saputra et al., 2021).

Furthermore, the compost produced not only provides benefits for agriculture but also contributes to environmental sustainability. The use of compost can increase soil fertility and reduce dependence on chemical fertilizers that have the potential to damage the ecosystem. In addition, the processing of organic waste into biogas provides an alternative source of energy that can be utilized by residents of Tegal Tugu Village. Thus, this initiative not only improves environmental quality but also creates new economic value, supporting the principle of a circular economy that focuses on reducing waste and reusing resources efficiently (Liao et al., 2023).

## Implementation of the Circular Economy Concept as an Environmentally Friendly Solution

The implementation of the circular economy concept in waste management in Tegal Tugu Village is a strategic step to create a more sustainable system. The circular economy focuses on waste reduction through reuse, recycling, and resource optimization (Jaeger-Erben et al., 2021). By implementing these principles, the village not only reduces the amount of waste produced but also creates new economic opportunities for residents. The application of a circular economy in the context of Tegal Tugu Village allows residents to view waste as a resource that can be reused. In this case, the process of sorting and processing organic waste into compost and biogas not only helps reduce negative impacts on the environment but also provides added value for residents. This is in line with research by Ramírez-Agudelo et al. (2021), which emphasizes the importance of integrating various economic actors in the implementation of circular economy principles as a whole.

By involving villagers, government, and the private sector in waste management, Tegal Tugu Village can create a strong synergy to support the success of this program. Education and training for villagers on waste sorting and processing techniques are essential to increase their active participation (Webster, 2021). In addition, the provision of adequate infrastructure, such as an efficient waste processing facility and facilities for the production of compost and biogas, will strengthen the implementation of a circular economy. Thus, Tegal Tugu Village will not only be an example of effective waste management but also contribute to sustainable and environmentally friendly economic development.

## Benefits to the Environment and Citizens

Circular economy-based organic waste management in Tegal Tugu Village provides significant benefits to both the environment and residents. Based on environmental aspects, good management can reduce the amount of waste disposed of in landfills (TPA) and prevent soil and water pollution (Ustaoğlu & Tepe, 2019). The composting and fermentation processes not only produce valuable products such as compost and biogas but also help reduce greenhouse gas emissions.

Reflecting on the socio-economic aspect, the positive impact of this system is very much felt by the residents of Tegal Tugu Village. The compost produced is used by local farmers to increase their agricultural yields while reducing dependence on chemical fertilizers. In addition, biogas is used as an alternative energy source for several households, thereby reducing their energy costs (Saputra, 2023). Overall, the implementation of a circular economy-based waste management

system in Tegal Tugu Village not only provides environmental benefits but also improves the quality of life of local villagers.

Furthermore, the success of the implementation of this system is highly dependent on the active participation of villagers in the waste management process. Education on the importance of waste sorting and the benefits of organic waste processing needs to be continuously carried out to increase awareness and community involvement (Saputra & Laksmi, 2024). In addition, support from the government in the form of supportive regulations and the provision of adequate facilities will greatly contribute to the sustainability of this program. With synergy between villagers, the government, and the private sector, Tegal Tugu Village can optimize its circular economy potential and create a cleaner and healthier environment for future generations. Strategic steps in education, infrastructure improvement, and collaboration can make Tegal Tugu Village potentially a model for sustainable and inspiring waste management for other areas in Bali.

# Conclusion

The management of organic waste based on a circular economy in Tegal Tugu Village has had a significant positive impact on the environment and villagers. Through waste sorting at the household level and processing at the Waste Processing Site (TPS), organic waste has been successfully converted into compost and biogas which are useful for the agricultural sector and as an alternative energy source. This approach not only reduces pollution and greenhouse gas emissions but also improves the overall cleanliness of the environment.

From a social perspective, this management system opens up new economic opportunities, creates jobs, and reduces residents' dependence on chemical fertilizers. In addition, this initiative also plays an important role in raising residents' awareness of the importance of sustainability and the need to protect the environment. Although challenges such as limited TPS capacity and irregular waste sorting still need to be overcome, ongoing educational steps and infrastructure improvements are needed to optimize the sustainability of this system. Thus, Tegal Tugu Village can be used as an example of an environmentally friendly solution that is mutually beneficial for villagers and the surrounding environment.

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