



# Integration of Community-Based Sustainable Waste Management in Circular Economy Policy: A Study in West Aceh Regency

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## Abstract

**Background:** Waste management has become one of the most pressing environmental challenges in West Aceh Regency, where population growth and consumption patterns continue to increase waste generation. Integrating community-based sustainable waste management into circular economy policies represents a strategic approach to balance environmental protection, economic growth, and social well-being. The Triple Bottom Line (TBL) framework focusing on the interconnection between *profit*, *people*, and *planet* offers a comprehensive lens to evaluate sustainability outcomes at the local level. This study aims to analyze how community-based waste management initiatives contribute to the implementation of circular economy principles in West Aceh Regency.

**Methods:** The research adopts a qualitative approach with an in-depth case study design. Data were collected through field observations, semi-structured interviews, and document analysis. Thematic analysis was employed to identify key patterns, enabling factors, and challenges in the integration process between community initiatives and local circular economy policies.

**Results:** The findings indicate that community participation manifested through waste banks, organic waste processing, and recycling-based microenterprises has generated multiple benefits, including additional household income, increased environmental awareness, and a reduction in domestic waste volume by up to 30% per month. Despite these achievements, several constraints persist, particularly in terms of infrastructure limitations, weak law enforcement, and inconsistent public engagement.

**Conclusions:** Strengthening sustainable waste management in West Aceh requires a more holistic policy framework that empowers communities through continuous education, institutional support, and multi-stakeholder collaboration. Integrating the TBL approach into local governance not only enhances environmental and social outcomes but also advances the realization of the Sustainable Development Goals (SDGs) at the regional level.

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## Keywords:

*Key Words: Waste Management, Circular Economy, Triple Bottom Line, Community Participation, West Aceh*

## Introduction

An increase in the population of an area has a direct impact on the increase in the volume of waste accumulation ([Maryanti & Januariana, 2023](#))([Manalu et al., 2022](#)). The province of Aceh is currently facing an increase in waste volume due to population growth. In 2024, the total waste accumulation in Aceh Province is estimated to reach 940 thousand tons. In West Aceh Regency, waste accumulation increases by about 2% each year and is expected to continue to grow ([Pasaribu et al., 2025](#))([Harahap et al., 2024](#)). SIPSN data shows that 39% of waste is not properly managed and most of it is disposed of directly in landfills without being sorted or recycled. In West Aceh Regency, waste is dominated by food waste (57%) and plastic (24%), with the main sources being households (55%) and the trade sector (21%).

Waste management in West Aceh Regency still faces a number of structural and social obstacles, including policies that have not been optimally implemented, low community participation, and uneven education ([Mardahtillah et al., 2025](#)). Limited landfill facilities, especially in densely populated areas, contribute to the practice of littering ([Zainuddin & Handayani, 2022](#)). The West Aceh Regency Government has issued Qanun No. 4 of 2017 concerning Waste Management, but its implementation still faces various obstacles, such as: first, increasing volume of waste; second, limited facilities; and third, low community participation ([Fridawaty et al., 2024](#)).

To address the waste problem in West Aceh, this study uses a combination of the Triple Bottom Line (TBL) theory and circular economy from Kirchherr, Reike, and Hekkert ([Kirchherr et al., 2017](#)). The TBL approach focuses on three key indicators, namely economic profit, social impact (people), and environmental impact (planet) ([Nurhidayat et al., 2020](#))([Handayani & Aminah, 2018](#)). It is also supported by the circular economy concept in sustainable waste management using three main principles, namely Reduce-Reuse-Recycle (3R) ([Nida & Sufianti, 2024](#))([Agamuthu & Babel, 2023](#)). With proper implementation, this concept can help create a cleaner environment, a more inclusive economy, and a society that is more aware of the importance of recycling and waste management ([Mujib et al., 2024](#))([Susanti et al., 2025](#)).

The specific objective of this study is to analyze community-based waste management policies by combining the Triple Bottom Line (TBL) theory, which emphasizes economic (profit), social (people), and environmental (planet) aspects, with the circular economy concept based on the principles of Reduce, Reuse, and Recycle (3R). This approach aims to create a cleaner environment, an inclusive economy, and increase public awareness of waste management and recycling in West Aceh Regency. This research is feasible and has a high urgency in promoting sustainable waste management in West Aceh Regency through a community-based approach, while also opening up economic opportunities and supporting the achievement of sustainable development goals (SDGs) at the regional level.

Previous studies on the implementation of waste management policies have been conducted extensively, particularly in encouraging community participation in waste management ([Handayani, 2018](#))([Reiza Macella et al., 2021](#)). Several studies have focused on regulatory challenges, noting that existing policies have not been fully implemented ([Michael et al., 2019](#))([Hartono et al., 2020](#)). Other studies highlight that law enforcement against environmental hygiene violations remains weak. The lack of strict sanctions for violators has resulted in many residents and businesses being undisciplined in managing their waste

([Handayani, 2018](#))([Widyaningsih, 2023](#)). In addition, coordination between local governments, communities, and the private sector in waste management is still not optimal, resulting in many cleanliness programs that are not sustainable ([Iqbal & Suheri, 2019](#)).

Although there are various studies related to community-based waste management, approaches that specifically promote the circular economy and combine community-based TBL theory are still rarely developed ([Yusa & Saputra, 2016](#)). Previous studies tend to separate circular economy and TBL studies as two separate approaches. However, the main obstacles to waste management in a region, apart from community participation, are a lack of resources, infrastructure, and economic aspects. Therefore, this study fills this gap by combining the two theories in order to formulate policies that emphasize waste reduction, reuse, and recycling to create a balance of economic, social, and environmental values in policy ([Lumi et al., 2023](#)).

The novelty of this research lies in the unique challenges in implementing waste management policies in areas with limited infrastructure and resources ([Meiwinda et al., 2024](#)). Furthermore, emphasizing the role of the community in building a community-based circular economy, including waste banking practices, organic waste processing, and the empowerment of recycling-based MSMEs ([Ihsan Tri Rengganis et al., 2021](#)). Policy formulation should not only focus on socialization, but also on practices to develop community potential and raise awareness of waste management in accordance with the 3R principle ([Komarudin et al., 2023](#)). The main contribution of this study is the proposal of a holistic policy model that can strengthen community-based circular economies to improve the balance between economic, social, and environmental aspects. This research is expected to produce more inclusive policy recommendations, reduce waste accumulation, and improve aspects of environmental sustainability.

## Methods

This study employed a qualitative approach with an in-depth case study design to examine the implementation and policy dynamics of community-based waste management within the framework of a circular economy in West Aceh Regency. The qualitative method was chosen to explore the phenomenon comprehensively by uncovering meanings, behavioral patterns, and subjective experiences of the involved actors ([Sugiyono, 2015](#)). Twenty informants were selected purposively to represent diverse stakeholders, including local government officials, community leaders, environmental activists, and waste management practitioners. This purposive sampling strategy aimed to capture various perspectives and experiences related to the integration of community-based initiatives into circular economy policies that seek to balance economic, social, and environmental dimensions.

Data were collected through field observations, in-depth interviews, and document analysis. Field observations were used to capture real practices and community engagement in waste management, while interviews explored stakeholder perceptions, motivations, and encountered challenges. Document analysis further complemented these findings by reviewing relevant policy documents, government reports, and local regulations. All qualitative data were analyzed thematically using NVivo software to ensure systematic coding, identification of key patterns, and interpretation of results. This analytical process enabled the study to identify critical implementation gaps and assess the extent to which community practices align with sustainability principles within the circular economy

framework.

## Results and Discussion

### Waste Generation and Management Challenges in West Aceh

The increase in population in West Aceh Regency has had a direct impact on the increase in waste volume, which has become one of the main environmental problems in this region. Based on data from the National Waste Management Information System (SIPSN) in 2024, Aceh Province produced a total of 940 thousand tons of waste, with West Aceh Regency contributing around 102.55 tons per year. The composition of waste in this area is dominated by food waste (57%) and plastic (24%), while the main sources are households (55%) and the trade sector (21%). The dominance of organic and plastic waste indicates high consumption patterns among the community and low awareness of waste sorting and management at the source.

This situation poses complex structural and social challenges. From a structural perspective, limitations in waste management infrastructure, including the number and capacity of final disposal sites (TPA), waste collection facilities, and recycling facilities, are significant obstacles. Many villages and densely populated areas still do not have adequate access to TPA, resulting in widespread indiscriminate waste disposal practices. This directly increases the risk of soil, water, and air pollution, as well as causing public health problems such as skin diseases, respiratory disorders, and the risk of disease vectors from accumulated waste ([Purwanti, 2021](#)).

From a social perspective, low community participation is a major obstacle. Many residents do not yet understand the importance of sustainable waste management, so waste sorting at the source is rarely done. Education on the principles of Reduce, Reuse, Recycle (3R) and the negative impact of waste on the environment is also uneven, so collective awareness is still limited to certain groups or areas that have been reached by government programs. Cultural factors and old habits, such as disposing of waste into rivers or drains, also exacerbate the problem ([Ilham et al., 2022](#)).

In addition, policy and regulatory aspects also influence the effectiveness of waste management. Although the West Aceh Regency Government has issued Qanun No. 4 of 2017 concerning Waste Management, its implementation still faces obstacles due to low law enforcement and weak coordination between the government, community, and private sector. This has resulted in some community-based waste management programs not running optimally and lacking sustainability. Therefore, waste management in West Aceh is not only a technical or administrative issue, but also a multidimensional challenge that requires a holistic approach, including continuous education, facility improvements, and community empowerment in order to create a cleaner, healthier, and more sustainable environment ([Handayani & Aminah, 2018](#)).

### Community-Based Waste Management and Triple Bottom Line (TBL)

The community-based waste management approach in West Aceh Regency can be analyzed through the Triple Bottom Line (TBL) framework, which emphasizes a balance between three main dimensions: economy (profit), society (people), and environment (planet). From an economic perspective, community initiatives such as waste banks, recycled MSMEs, and the processing of organic waste into compost have opened up additional income

opportunities for the community. Waste that was previously worthless can now be turned into products that have economic value, such as organic fertilizer, crafts made from used plastic, or raw materials for the creative industry. Several community groups in West Aceh reported that through the waste bank program, members can earn an additional income of around 200,000 to 500,000 rupiah per month, depending on the type and volume of waste deposited, so this activity also provides an economic incentive for sustainable participation.

From a social perspective, community-based waste management encourages active community participation in maintaining environmental cleanliness. This activity not only raises individual awareness of the importance of waste sorting and processing but also strengthens social cohesion among residents. For example, the formation of waste management groups at the village level fosters cooperation and collective responsibility, where residents routinely work together to clean the environment, recycle waste, and support other members in waste management activities. Interviews with a number of informants show that these community activities strengthen a sense of ownership of the environment, increase positive social interaction, and build a culture of environmental awareness in the community.

From an environmental perspective, the application of the Reduce, Reuse, and Recycle (3R) principles has proven effective in reducing the amount of waste going to landfills. Observations and field data show that communities that actively apply the 3R principles can reduce household waste by up to 30% per month. This reduction not only reduces pressure on landfills but also lowers the potential for soil and water pollution caused by accumulated organic and inorganic waste. Reuse and recycling of waste, such as processing plastic into raw materials for handicrafts, helps minimize unused waste and encourages more efficient use of resources. This implementation is in line with the concept of a circular economy, where waste is considered a resource that can be reused, not simply discarded ([Borchard et al., 2022](#))([Widayanti et al., 2024](#)).

Furthermore, TBL-based waste management demonstrates the interdependence between economic, social, and environmental dimensions. The economic success of recycled products increases the motivation of the community to become more actively involved in environmental activities, while increased social awareness strengthens compliance with sustainable waste management practices. For example, community groups that have routinely utilized organic waste for composting report improved soil quality in their home gardens, while also reducing the cost of purchasing chemical fertilizers. This shows that community-based waste management not only generates direct economic benefits, but also simultaneously strengthens social quality and environmental health ([Elkington, 1994](#))([Kirchherr et al., 2017](#)).

In addition, these community activities also have the potential to be replicated in other regions, given the successful integration of TBL in the local context of West Aceh. Proper implementation enables significant waste reduction, increases household income, builds collective awareness, and supports the creation of a clean and sustainable environment. In other words, community-based waste management that integrates TBL and the 3R principles can be a holistic strategy to achieve a balance between economic, social, and environmental aspects while strengthening the community's capacity to face future waste management challenges ([Elkington & Rowlands, 1999](#))([Michael et al., 2019](#)).

## Implementation of Circular Economy in Waste Management

The circular economy emphasizes the sustainable reuse of waste and resources, not only reducing waste but also creating economic, social, and environmental value simultaneously. In West Aceh Regency, the implementation of the circular economy can be seen through various community-based initiatives, including the processing of organic waste into compost, the manufacture of recycled products from plastic, paper, and other organic materials, and the establishment of village-based waste banks that function as centers for waste education and trade. Field observations show that community groups participating in this program are able to process around 60% of organic waste into fertilizer, which is then used for home gardens, small-scale agricultural land, or sold as organic fertilizer with economic value. Most of the collected plastic and paper waste is processed into handicrafts, recycled bags, and raw materials for local creative industries, so that waste that was previously worthless has now become an additional source of income for the community ([Kristianto, 2020](#))([Kamanga et al., 2024](#)).

In addition to economic benefits, the implementation of a circular economy has a significant social impact. Community participation in this program improves technical skills, such as processing waste into compost or recycled crafts, and builds collective awareness of the importance of sustainable waste management. This activity also encourages positive social interaction among residents, especially in community work groups, which indirectly strengthens social solidarity and shared responsibility for the environment. For example, village waste banks not only manage waste but also serve as education centers that teach families and children about waste sorting, the 3R principles, and the economic benefits of properly managed waste ([Larasati & Santoso, 2023](#))([Yuniar, 2024](#)).

From an environmental perspective, the circular economy helps reduce pressure on landfills, lower the risk of soil and water pollution, and reduce greenhouse gas emissions from the decomposition of organic waste. Consistent implementation of the Reduce, Reuse, and Recycle principles results in a significant reduction in household and small industrial waste, while minimizing the use of new resources. This practice also encourages innovation in new products from waste, such as high-quality organic fertilizers, mixed compost, and plastic-based crafts, which add value to the community and strengthen the local economy.

Furthermore, the integration of the circular economy with the Triple Bottom Line (TBL) theory creates a holistic approach. Economically (profit), this program increases community income through recycled products and the commercialization of organic waste. Socially (people), this activity increases community participation, knowledge, and awareness of waste management, while strengthening community cohesion. Environmentally (planet), reducing waste to landfills and more efficient waste management have long-term positive impacts on soil, water, and air quality. In other words, the implementation of a circular economy not only solves waste problems but also generates multiplicative benefits, improving the quality of life for communities, strengthening the local economy, and maintaining environmental sustainability ([Nurhidayat et al., 2020](#))([Lubis & Faridy, 2024](#)).

Overall, circular economy practices in West Aceh Regency demonstrate that waste can be transformed into valuable resources, and this success underscores the importance of a community-based approach that integrates education, simple technology, and economic

incentives. This model also serves as evidence that waste management is not solely the responsibility of the government but also requires the active participation of empowered communities, thereby creating a sustainable and inclusive waste management ecosystem.

### Barriers and Opportunities for Holistic Policies

Although various waste management programs have been launched in West Aceh Regency, this study found a number of significant obstacles to their implementation. First, infrastructure limitations are a major challenge. Existing landfill facilities are still limited in terms of both capacity and distribution, so that some villages and densely populated areas do not have adequate access to regular waste disposal. Waste collection facilities such as truck fleets, temporary storage sites, and waste sorting facilities at the village level are also inadequate. This situation causes waste to accumulate in households or be disposed of indiscriminately, increasing the risk of environmental pollution, flooding, and potential diseases transmitted by vectors such as flies and rats.

Second, low community participation is an equally important social obstacle. The lack of continuous education and socialization related to the principles of Reduce, Reuse, Recycle (3R) has made the community passive in waste management. Many residents do not understand the long-term impact of poorly managed waste, so collective awareness of maintaining environmental cleanliness is still weak. Cultural factors and old habits, such as dumping waste into rivers or ditches, exacerbate this condition. In addition, the lack of clear economic incentives for active participants also reduces the motivation of the community to regularly engage in waste management activities ([Latif, 2022](#))([Bachtiar et al., 2015](#)).

Third, regulatory and law enforcement aspects remain a challenge. Although Qanun Number 4 of 2017 concerning Waste Management has been issued, its implementation has not been fully effective. Law enforcement against environmental cleanliness violations is weak, and sanctions for violators are not consistently applied. As a result, some communities and businesses remain indifferent to waste management, which hinders the creation of collective discipline in waste management ([Lestari & Halimatussadiah, 2022](#))([Priyadi et al., 2023](#)).

On the other hand, this study also found considerable opportunities to strengthen waste management through a holistic community-based approach. Community empowerment is key, for example through the establishment of waste banks, waste management groups at the village level, and training in waste processing into compost or recycled products. Multi-stakeholder collaboration between the government, community, and private sector also opens up space for innovation, such as program funding, provision of waste collection facilities, and development of markets for recycled products ([Saipullah et al., 2023](#)).

A successful holistic policy strategy must integrate four key elements. First, continuous education that emphasizes the 3R principle and the economic benefits of waste management. Second, community empowerment to create internal motivation and collective awareness. Third, adequate infrastructure development to support the waste collection, sorting, and processing processes. Fourth, the provision of economic incentives, for example through the purchase of recycled products or rewards for community groups that succeed in reducing waste. This approach simultaneously strengthens the circular economy, improves the social quality of society, and maintains environmental sustainability.

Furthermore, the integration of this holistic strategy is in line with the Sustainable

Development Goals (SDGs), particularly the targets of clean environment and decent sanitation (SDG 6), poverty alleviation through the local economy (SDG 1 and 8), and sustainable cities and communities (SDG 11). With proper implementation, this policy can not only reduce waste generation and improve environmental quality, but also open up new economic opportunities for the community, strengthen social solidarity, and create a sustainable environmental awareness culture. This shows that the success of waste management in West Aceh Regency is highly dependent on the synergy between regulations, infrastructure, community empowerment, and community-based economic incentives.

## Conclusion

Waste management in West Aceh Regency continues to face complex challenges, including population growth, limited infrastructure, low public participation, and weak enforcement of environmental regulations. This study demonstrates that community-based waste management integrating the principles of the Triple Bottom Line (TBL) and circular economy through the Reduce, Reuse, and Recycle (3R) approach can generate simultaneous economic, social, and environmental benefits. Empowering communities, providing continuous education, and fostering multi-stakeholder collaboration are essential strategies to enhance waste reduction, improve environmental awareness, and promote sustainable local development.

However, this study has several limitations. The qualitative case study design limits the generalizability of findings to other regions with different socio-economic or institutional contexts. Moreover, the analysis primarily focused on stakeholder perceptions and policy implementation, without quantitatively measuring the long-term environmental or economic impacts. Future research should consider a mixed-methods approach that integrates quantitative data such as waste volume reduction metrics or cost-benefit analyses to provide a more comprehensive assessment of program effectiveness. Comparative studies across regions could also help identify best practices and policy innovations to strengthen sustainable waste management and circular economy integration at the regional and national levels.

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