



Research Article

Community-Based Waste Management in Gampong Paya Peunaga, West Aceh: Institutional Challenges, Community Participation, and the 3R Approach

Durrah Nafisa¹, Najamudin²

^{1,2}Department of Public Administration, Teuku Umar University, Indonesia

Abstract

Waste management in Gampong Paya Peunaga, West Aceh Regency, remains ineffective, resulting in adverse consequences for public health and the surrounding environment. Poorly managed plastic and domestic waste contribute to water, soil, and air pollution and may increase the risk of health problems, including diarrhea, respiratory infections, and skin disorders. Waste accumulation also creates conditions conducive to disease-vector proliferation and threatens coastal ecosystems that serve as an important source of livelihood for local residents. This study aims to analyze the factors contributing to ineffective waste management and examine efforts to increase community awareness through the principles of reduce, reuse, and recycle (3R). A qualitative approach was employed, with data collected through interviews, field observations, and an educational activity on transforming plastic waste into handicrafts. The findings indicate that low community awareness and limited waste-management facilities are the main barriers to effective waste management. The educational activity also encouraged greater awareness and creativity among young people in utilizing plastic waste. The study concludes that strengthening local institutions, improving waste-management infrastructure, and fostering collaboration among government, communities, and businesses are essential for improving waste management and reducing its potential adverse effects on public health and the environment.

Keywords: Waste Management, Community Participation, Institutional Capacity, 3R Approach

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¹ Corresponding e-mail: najamudin@utu.ac.id

Introduction

Plastic waste has emerged as one of the most critical environmental issues facing Indonesia today. Previous studies indicate that Indonesia ranks second globally after China in terms of the amount of plastic waste entering and polluting marine waters, with an estimated 187.2 million tons of plastic waste (Septiani et al., 2019). As an illustration of the scale of plastic consumption, plastic bags generated by only 100 retail stores affiliated with the Indonesian Retail Entrepreneurs Association (APRINDO) were estimated to reach 10.95 million bags in a single year, equivalent to a total area of approximately 65.7 hectares (Ministry of Environment and Forestry). The volume of plastic waste has also increased by approximately 15% annually, indicating that the problem is becoming increasingly serious and requires sustained policy attention. The persistence of plastic waste, which can take decades or even centuries to decompose, further exacerbates its environmental consequences by contributing to declining soil quality and water pollution.

Residential areas are a major source of waste generation, with approximately 75% consisting of organic waste and the remainder being inorganic waste. On average, each individual generates more than half a ton of waste annually (Apriyani et al., 2020). However, community behavior regarding waste management remains far from ideal. Although some consumers bring their own reusable shopping bags, they may still request plastic bags, indicating that plastic consumption has become embedded in contemporary lifestyles. Improper waste disposal is also practiced across different segments of society, including both lower-income groups and highly educated individuals. This situation suggests that public awareness and environmental education concerning the adverse effects of improper waste management on the environment and public health remain inadequate (Kurniawati et al., 2022).

The consequences of poor waste management are extensive and potentially harmful to both public health and the environment. Accumulated waste can provide breeding grounds for disease vectors such as flies, rats, and mosquitoes, which may contribute to the transmission of diseases including dengue fever, malaria, diarrhea, and parasitic infections (Axmalia & Mulasari, 2020). Inadequately managed waste may also contaminate water and soil through hazardous substances and chemical residues, potentially increasing the risk of health problems such as skin infections and the transmission of viruses, including Hepatitis B and HIV (Fauzi et al., 2020). Air pollution is another consequence of improper waste management, particularly where open burning releases hazardous substances such as methane and dioxins, which can contribute to respiratory problems and long-term health risks. In addition to these physical health and environmental consequences, living in unclean and waste-polluted surroundings may contribute to psychological stress and reduced quality of life among community members.

The challenge of waste management has become increasingly urgent amid rapid population growth and urbanization. In 2023, Indonesia generated more than 33 million tons of domestic waste annually, of which only approximately 49.39% was managed, while around 36.36% remained inadequately managed (Darwisman, S. 2026). The continued accumulation of waste contributes to environmental degradation, increases the risk of flooding during the rainy season, generates unpleasant odors, and may adversely affect overall public health. These conditions underscore the need for more effective waste management and highlight the importance of sustained attention and coordinated efforts from both government institutions and communities.

Effective and sustainable waste management requires collaboration among multiple stakeholders, ranging from waste generators to waste collection and treatment systems, including Temporary Waste Disposal Sites (TPS) and Final

Disposal Sites (TPA). The adoption of appropriate technologies is also essential for improving the efficiency and effectiveness of waste management practices. Although the government has undertaken various efforts to promote a clean and sustainable environment, one of the major challenges remains the low level of public awareness regarding the importance of maintaining environmental cleanliness and managing waste responsibly ([Kurniawati et al., 2022](#)). At a broader level, waste management is part of an increasingly complex and urgent global environmental challenge. Pollution caused by waste not only threatens ecosystems in Indonesia but also contributes to global warming (Putri et al., 2023). As waste generation continues to increase alongside urbanization and population growth, ineffective waste management may further exacerbate global environmental and public health challenges.

Therefore, environmental education represents a strategic approach to increasing public awareness of the importance of proper waste management. Educational approaches that extend beyond theoretical knowledge to foster environmentally responsible attitudes and behaviors can encourage positive changes in waste management practices at both the individual and community levels.

Various environmental education programs implemented in schools, communities, and non-governmental organizations have demonstrated their potential to influence community behavior, including reducing waste generation and increasing awareness of responsible waste management ([Cerya & Evanita, 2021](#)). Nevertheless, several challenges continue to hinder the effective implementation of environmental education, including limited public understanding of the long-term consequences of poor waste management and constraints related to resources and infrastructure. An integrated and sustainable approach is therefore necessary to ensure that environmental education and

awareness can be disseminated more broadly and generate meaningful impacts across different segments of society.

Based on the foregoing discussion, waste management has become a serious and increasingly urgent issue in Indonesia, particularly in relation to plastic waste, which is difficult to decompose and poses significant risks to the environment and public health. Inadequate waste management can contribute to environmental pollution and increase health risks, highlighting the need for concrete and coordinated action among relevant stakeholders. Environmental education represents one important approach to addressing this challenge by increasing public awareness and encouraging behavioral change toward more responsible waste management practices. In this context, this study focuses on the waste management conditions in Gampong Paya Peunaga, West Aceh, with particular attention to the factors contributing to ineffective waste management and efforts to strengthen community awareness through the principles of reduce, reuse, and recycle (3R).

Literature Review

Waste management at the community level can be understood as a collective action problem because maintaining a clean and healthy environment requires the participation and cooperation of multiple actors. Ostrom (1990) explains that collective action can be sustained when individuals and groups are able to establish shared rules, develop trust, participate in decision-making, and create mechanisms for monitoring collective behavior. These principles are relevant to waste management because the benefits of a clean environment are shared by the community, while irresponsible waste disposal can impose environmental and health costs on others. Consequently, waste management cannot rely solely on government intervention but requires collective responsibility among households, community organizations, government

institutions, and other relevant stakeholders. This perspective is supported by Oh and Hettiarachchi (2020), who applied the Institutional Analysis and Development framework to examine recycling and waste-recovery initiatives in Brazil, Indonesia, and Nigeria. Their study demonstrates that collective action plays an important role in shaping the performance of community-based waste initiatives and that institutional arrangements, stakeholder relationships, and local participation influence the sustainability of such initiatives. Similarly, research on community-based waste management in Indonesia has emphasized the importance of institutional arrangements and multi-stakeholder collaboration. Pamuji et al. (2023), for example, found that community-based waste management in Banyumas required institutional arrangements that could strengthen cooperation among village government, community groups, and other waste-management actors. These findings suggest that ineffective waste management should not be viewed solely as a consequence of inadequate community awareness, but also as a problem of collective action and institutional coordination.

Institutional capacity is another important factor in determining the effectiveness and sustainability of waste management. Institutional capacity refers to the ability of public institutions and related actors to formulate and implement programs, coordinate responsibilities, mobilize resources, and provide the infrastructure required to achieve policy objectives. In waste management, limited institutional capacity may be reflected in weak coordination among government agencies, inadequate waste-management facilities, unclear division of responsibilities, and insufficient support for community-based initiatives. Munawir et al. (2024), in their study of waste management sustainability in Kambu District, Kendari City, found that institutional synergy and government involvement were key factors in sustaining waste-management programs. Their findings also emphasized the importance of improving and maintaining waste-management facilities and infrastructure while strengthening community involvement through

waste reduction, recycling, and reuse. These findings indicate that community participation alone is insufficient when it is not supported by adequate institutional arrangements and public infrastructure. Similarly, Pamuji et al. (2023) found that community-based waste management in Banyumas required institutional arrangements that could strengthen cooperation among village governments, community groups, and other waste-management actors. Their study highlights the importance of establishing appropriate institutional structures and strengthening collaboration to support community-based waste management.

Community participation is closely associated with the effectiveness of environmental programs because waste management requires behavioral changes at the household and community levels. Environmental education can serve as an important mechanism for encouraging such participation by increasing knowledge, awareness, and practical skills related to waste reduction and responsible waste disposal. Prasetya et al. (2025), in their study of domestic waste management in Padukuhan Nayan, Yogyakarta, found that environmental education through socialization, training, and community-based activities contributed to increased awareness and participation in waste sorting, community clean-up activities, and waste-bank programs. However, the study also showed that participation was not always consistent and depended on factors such as motivation, institutional support, and program sustainability. Similarly, Rachman et al. (2021) found that the involvement of community leaders and residents was important in reducing the amount of waste transported to landfills, while cooperation between communities and government agencies supported more effective waste management practices. These findings suggest that environmental education should not be viewed merely as a process of transferring knowledge but as a means of developing community capacity and encouraging sustained participation in public environmental management. For local governments, this implies that waste-management policies need to combine public education with

institutional support, opportunities for participation, and mechanisms that enable communities to translate environmental awareness into everyday practices.

The principles of Reduce, Reuse, and Recycle (3R) provide an important approach to community-based waste management by shifting waste management practices from a predominantly collection-and-disposal model toward waste reduction and resource recovery at the community level. Puspitawati and Rahdriawan (2012), in their study of community-based waste management in Larangan, Cirebon, found that the implementation of the 3R concept was closely associated with community participation, empowerment, and changes in waste-management behavior. Their findings indicate that community-based waste management can improve environmental quality while encouraging residents to integrate waste reduction practices into their daily activities. More recent evidence also demonstrates that education and practical activities based on the 3R principles can strengthen community awareness and participation, particularly when residents are involved in waste sorting, recycling, and the transformation of waste into useful products. These findings suggest that the implementation of 3R should not be understood merely as a technical method of waste processing. Rather, it can function as a community empowerment and public-management instrument that requires continuous education, institutional support, and opportunities for meaningful community participation. Consequently, the effectiveness of 3R initiatives depends not only on individual awareness but also on the capacity of local institutions to facilitate, coordinate, and sustain collective action.

Collectively, the literature indicates that effective community-based waste management is shaped by the interaction between institutional capacity, collective action, community participation, and practical mechanisms such as the 3R approach. Previous studies have demonstrated the importance of institutional arrangements and multi-stakeholder collaboration (Pamuji et al., 2023),

community participation and empowerment in implementing 3R-based waste management (Puspitawati & Rahdriawan, 2012), and public involvement in waste sorting and reduction practices. Research in Aceh has also demonstrated the potential of community participation in implementing 3R programs, as shown in Gampong Nusa, Aceh Besar. However, the effectiveness of community-based waste management remains highly dependent on local institutional and social conditions. Existing studies have largely examined established community-based programs or assessed levels of participation, while less attention has been given to local contexts where ineffective waste management persists alongside limited infrastructure and low public awareness. This study therefore examines waste management in Gampong Paya Peunaga, West Aceh, by identifying the factors contributing to ineffective waste management and examining community education through the 3R principles as an effort to strengthen public awareness and participation. By focusing on the interaction between institutional support, community behavior, and environmental education, the study seeks to provide a contextual understanding of the challenges faced in improving waste management at the village level.

Methods

This study employed a qualitative descriptive approach to explore how the waste management system operates in West Aceh Regency and its implications for public health and the local environment. This approach was selected to provide an in-depth understanding of the realities of waste management practices in the field, including patterns of waste disposal, waste-management practices implemented by the local government, and community responses to waste-related problems in their surroundings.

Data were collected through field observations, in-depth interviews, and documentation. Field observations were conducted at several waste disposal

points, including roadside areas and open land in Gampong Paya Peunaga. In-depth interviews were conducted with individuals directly involved in waste management and community members affected by waste accumulation. Documentary data included photographs, official reports, and available public health data. Informants were selected purposively based on their knowledge of and involvement in waste management issues in West Aceh Regency. The informants included the Head of the Environmental Cleanliness Division at the West Aceh Environmental and Sanitation Agency, officials from the West Aceh Health Office, the Head of Johan Pahlawan Subdistrict, a driver of a waste-collection dump truck operated by the Environmental Agency, and residents of Meureubo Subdistrict who had experienced the effects of accumulated waste.

The collected data were analyzed descriptively by identifying relevant information from observations, interviews, and documents, followed by organizing and interpreting the findings according to the research objectives. The analysis focused on identifying the factors contributing to ineffective waste management, the implications of waste accumulation for the community and environment, and the role of community awareness and environmental education in improving waste-management practices.

All collected information was analyzed using the interactive model of data analysis developed by Miles and Huberman. The analysis consisted of three stages: data reduction, data display, and conclusion drawing and verification. During the data reduction stage, the researchers selected, focused, and organized information related to waste-management practices, the factors contributing to the emergence of informal waste disposal sites, and their implications for public health and the environment. Data display was conducted by organizing interview findings, field observations, and documentary evidence into tables, matrices, and thematic descriptions to clarify relationships among the identified factors. The final stage involved drawing and verifying conclusions by interpreting emerging

patterns, including the relationships between limited waste-disposal facilities, weak village-level regulations, and low community awareness. The findings were continuously cross-checked across different data sources throughout the research process to strengthen the credibility of the analysis.

Results and Discussion

Field observations in Gampong Paya Peunaga revealed that household waste was frequently disposed of along the shoulders of the village's main road, which directly borders shrubs and agricultural areas. The waste consisted predominantly of plastic bags, food wrappers, beverage bottles, paper, and other single-use packaging materials. These materials had accumulated along the roadside, with some waste extending onto the road surface. The condition indicates the absence of adequate waste separation and designated waste-collection facilities at the community level. The area had informally become a waste disposal site because some residents perceived the roadside as an available open space for disposing of household waste, particularly in the absence of accessible Temporary Waste Disposal Sites (TPS) near residential areas.

Interviews with several residents living near the site indicated that the area had been used for waste disposal for an extended period because it was considered the most convenient and accessible location from their homes. Residents also reported that the village did not have an adequate TPS and that waste-collection vehicles rarely entered their residential areas. Consequently, household waste was temporarily collected in front of residents' homes before being transported to the roadside, which gradually developed into an informal waste disposal site. These findings indicate that improper disposal practices cannot be attributed solely to individual community behavior. The lack of accessible waste-management infrastructure and limited waste-collection services also shape residents' disposal choices. From a public administration perspective,

this situation illustrates the importance of institutional capacity and the provision of basic public services in supporting responsible community behavior. Without adequate facilities and regular collection services, efforts to encourage behavioral change may have limited effectiveness because residents have few practical alternatives for disposing of their household waste.



Figure 1. Waste Disposal in Gampong Paya Peunaga

Source: Field documentation of waste scattered along a village roadside in Gampong Paya Peunaga

Analysis of Community-Based Waste Management in Gampong Paya Peunaga

The findings indicate that waste management in Gampong Paya Peunaga remains inconsistent with the principles of effective waste management, particularly the 3R principles (Reduce, Reuse, and Recycle). As discussed in the literature review, the 3R approach represents a shift toward preventing waste generation, promoting the reuse of materials, and recycling waste to reduce the volume of waste sent to final disposal sites and minimize environmental impacts. In practice, however, residents in Gampong Paya Peunaga continue to rely predominantly on a “collect-transport-dispose” pattern, with limited efforts to reduce waste at the source or separate different types of waste. The accumulation of waste along the roadside, as shown in Figure 1, reflects weaknesses in the village-level waste management system and limited enforcement of environmental

cleanliness regulations. The lack of adequate Temporary Waste Disposal Site (TPS) facilities and irregular waste collection services appear to be major factors contributing to indiscriminate waste disposal. This finding is consistent with Kurniati et al. (2022), who identified inadequate infrastructure and low community awareness as major barriers to effective waste management in Indonesian villages.

Community Participation and the Importance of Environmental Education

The low level of community participation in waste management in Gampong Paya Peunaga indicates that environmental education efforts implemented to date have not been sufficiently effective in changing community behavior. As highlighted in the theoretical framework, environmental education plays a strategic role in increasing public awareness of responsible waste management and the negative consequences of indiscriminate waste disposal. However, one-time or unsustained educational programs, particularly when not accompanied by adequate supporting facilities and incentives for active community participation, are unlikely to change deeply rooted waste-disposal practices. A more participatory approach grounded in local knowledge and community conditions is therefore needed to strengthen the effectiveness of environmental education programs. Such an approach could involve community leaders, religious leaders, and youth groups as active partners in promoting and sustaining responsible waste-management practices.

In addition, establishing and strengthening community-based waste banks at the neighborhood or hamlet level could provide an effective mechanism for encouraging waste separation and recycling. Economic incentives generated from the sale of recyclable materials may motivate residents to change their waste-management practices and recognize waste not merely as unwanted material but also as a potential source of economic value.

Implications for Public Health and the Environment

The ineffective management of waste in Gampong Paya Peunaga has significant implications for public health. Residents reported cases of illnesses such as diarrhea, acute respiratory infections (ARI), and skin disorders, which they associated with the poor environmental conditions surrounding their homes. These reports highlight the potential health risks associated with inadequate waste management, particularly where accumulated waste creates conditions conducive to the proliferation of disease vectors such as flies, mosquitoes, and rats. This finding is consistent with the World Health Organization's broader perspective that inadequately managed waste can contribute to environmental conditions that facilitate the transmission of various diseases through disease vectors.

From an environmental perspective, the accumulation and improper disposal of waste may contribute to soil, water, and air pollution, potentially degrading local ecosystems and natural resources that support community livelihoods, particularly agriculture and fisheries. Pollution of groundwater and other water sources may have long-term consequences and can be difficult to reverse, highlighting the need for timely intervention to prevent further environmental degradation. Beyond its physical impacts, an unclean and waste-polluted environment may also affect community well-being and quality of life. Poor environmental conditions can contribute to psychological stress, reduce residents' sense of pride in their village, and potentially weaken their motivation to participate in community development activities.

Policy Recommendations and Waste Management Strategies

Based on the findings, this study recommends several policy strategies to improve the effectiveness of waste management in Gampong Paya Peunaga:

1. *Provision of waste-disposal facilities.*

Adequate Temporary Waste Disposal Sites (TPS) and separated waste bins should be provided at strategic locations, such as near markets, schools, and densely populated residential areas, to facilitate proper waste disposal by residents.

2. *Improvement of waste collection services.*

The frequency and reliability of waste collection services provided by the Environmental Agency (DLH) should be improved to prevent waste from accumulating in residential areas.

3. *Implementation of continuous environmental education.*

Sustainable environmental education programs should involve community leaders, religious leaders, and youth groups to increase public awareness and encourage behavioral change through participatory approaches.

4. *Strengthening of waste bank programs.*

Existing waste bank programs should be expanded and strengthened through economic incentives and technical assistance to encourage greater community participation in waste separation and recycling.

5. *Strengthening of village-level regulations.*

Village regulations (*Peraturan Gampong*) governing community responsibilities for waste management should be established or strengthened, accompanied by appropriate sanctions for violations to promote compliance and effective enforcement.

6. *Development of environmentally friendly waste-treatment technologies.*

Appropriate technologies, such as organic waste composting and biogas production, should be developed to reduce the volume of waste transported to final disposal sites while generating potentially valuable by-products.

The comprehensive and integrated implementation of these strategies is expected to improve waste management practices in Gampong Paya Peunaga and contribute to better public health and environmental sustainability. More importantly, effective waste management requires coordination among local government institutions, communities, and other relevant stakeholders to ensure that infrastructure provision, public education, community participation, and regulatory enforcement operate as mutually reinforcing components of the local waste-management system.

Conclusion

Based on the findings of this qualitative study in Gampong Paya Peunaga, waste management at the village level remains at a basic stage and has not yet adequately incorporated the principles of Reduce, Reuse, and Recycle (3R). Household waste, particularly plastic and single-use packaging, is frequently disposed of along roadsides and on vacant land without adequate waste separation, regular collection, or further treatment. These conditions indicate that the local waste-management system has not yet been adequately established, both in terms of physical infrastructure and institutional arrangements at the village level.

This situation has significant implications for public health and environmental quality. Waste accumulation creates conditions conducive to the presence of disease vectors such as flies, mosquitoes, and rats, potentially increasing health risks, including diarrhea, acute respiratory infections (ARI), and skin disorders among residents. Meanwhile, soil and water pollution resulting from waste accumulation in agricultural areas and drainage channels poses a potential threat to the sustainability of natural resources that support local livelihoods, particularly agriculture and fisheries.

References

- Apriyani, A., Putri, M. M., & Wibowo, S. Y. (2020). Pemanfaatan sampah plastik menjadi ecobrick. *Masyarakat Berdaya Dan Inovasi*, 1(1), 48-50. <https://doi.org/10.33292/mayadani.v1i1.11>
- Axmalia, A., & Mulasari, S. A. (2020). Dampak Tempat Pembuangan Akhir Sampah (TPA) Terhadap Gangguan Kesehatan Masyarakat. *Jurnal Kesehatan Komunitas*, 6(2), 171-176. <https://doi.org/10.25311/keskom.vol6.iss2.536>
- Cerya, E., & Evanita, S. (2021). Strategi Komunikasi Lingkungan dalam Membangun Kepedulian Masyarakat dalam Pengelolaan Sampah Rumah Tangga. *JRTI (Jurnal Riset Tindakan Indonesia)*, 6(2), 136. <https://doi.org/10.29210/3003977000>
- Darwisman, S. (2026). Waste-to-energy implementation in Indonesia: A comprehensive comparative analysis of technological, economic, and socio-environmental paradigms. *International Journal of Management and Business*, 3(4), 1-38.
- Fauzi, M., Sumiarsih, E., Adriman, A., Rusliadi, R., & Hasibuan, I. F. (2020). Pemberdayaan masyarakat melalui pelatihan pembuatan ecobrick sebagai upaya mengurangi sampah plastik di Kecamatan Bunga Raya. *Riau Journal of Empowerment*, 3(2), 87-96. <https://doi.org/10.31258/raje.3.2.87-96>
- Kurniawati, E., & Ali, I. (2024). Strategi Pengelolaan Sampah Organik Untuk Mendukung Program Kesehatan Lingkungan Di Desa-Desa Indonesia. *Seminar Nasional LPPM UMMAT*, 3, 558-569.
- Munawir, A., Rusdiyanto, E., Muna, S. U. N., Yunandar, Ali, F., & Ihsan, M. (2024). Improving waste management sustainability: The role of institutional capacity and program objectives. *Jurnal Pengelolaan Sumberdaya Alam dan Lingkungan*, 14(3), 598. <https://doi.org/10.29244/jpsl.14.3.598>
- Oh, J., & Hettiarachchi, H. (2020). Collective action in waste management: A comparative study of recycling and recovery initiatives from Brazil, Indonesia, and Nigeria using the Institutional Analysis and Development framework. *Recycling*, 5(1), 4. <https://doi.org/10.3390/recycling5010004>
- Ostrom, E. (1990). *Governing the commons: The evolution of institutions for collective action*. Cambridge University Press.
- Pamuji, K., Rosyadi, S., & Nasihuddin, A. A. (2023). The legal institutional model of community-based waste management to reinforce multi-stakeholder collaboration in Indonesia. *Kasetsart Journal of Social Sciences*, 44(1), 73-82.
- Prasetya, A., Sulaiman, M., Tapiory, J. G., & Suanto, L. (2025). The role of education and community participation in domestic waste management in Padukuhan Nayan, Yogyakarta. *Jurnal Pengabdian, Riset, Kreativitas, Inovasi, dan Teknologi Tepat Guna*, 3(2), 450-461. <https://doi.org/10.22146/parikesit.v3i2.25865>
- Puspitawati, Y., & Rahdriawan, M. (2012). Kajian pengelolaan sampah berbasis masyarakat dengan konsep 3R (Reduce, Reuse, Recycle) di Kelurahan Larangan Kota Cirebon. *Jurnal Pembangunan Wilayah dan Kota*, 8(4), 349-359.

<https://doi.org/10.14710/pwk.v8i4.6490>

- Rachman, I., Komalasari, N., & Hutagalung, I. R. (2021). Community participation on waste bank to facilitate sustainable solid waste management in a village. *Journal of Environmental Science and Sustainable Development*, 4(2), 327-345. <https://doi.org/10.7454/jessd.v4i2.1123>
- Rahayu, Y. S., Nuraeni, S., Kaustara, N. R., Maulana, N. A., & Nuryadi, D. P. (2024). Pengelolaan Sampah Plastik Dalam Skala Kecil: Peran Masyarakat Dalam Mengurangi Dampak Lingkungan. *HUMANUS : Jurnal Sosiohumaniora Nusantara*, 1(2), 187-197. <https://doi.org/10.62180/r4hjcb91>
- Septiani, B. A., Arianie, D. M., Risman, V. F. A. A., Handayani, W., & Kawuryan, I. S. S. (2019). Pengelolaan Sampah Plastik Di Salatiga: Praktik, dan tantangan. *Jurnal Ilmu Lingkungan*, 17(1), 90. <https://doi.org/10.14710/jil.17.1.90-99>