



Community Service Report

Community Empowerment through Biopore Infiltration Holes for Sustainable Waste Management in Gowa Regency

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ABSTRACT

Population growth and increasing household activities have led to a continuous rise in waste generation, while community capacity to implement sustainable waste management practices is still limited. This condition was also identified in Sunggumanai Hamlet, Parangloe District, Gowa Regency, where low public awareness of waste segregation, limited waste management facilities, and the common practice of open waste burning were the main issues. This community service program aimed to improve community knowledge and participation in sustainable waste management through education, mentoring, and the implementation of Infiltration Biopore Holes (Lubang Resapan Biopori/LRB) as a simple, affordable, and environmentally friendly technology for organic waste management. The methods employed included the preparation stage, development of educational materials, community counseling, hands-on biopore construction training, and continuous assistance throughout the implementation process. The results indicated that the program successfully increased community understanding of waste segregation, encouraged the utilization of organic waste as compost through biopore technology, and enhanced community participation in maintaining environmental cleanliness. Furthermore, the innovation of using bamboo as a biopore casing provided a cost-effective alternative by utilizing locally available resources. Overall, the program contributed to reducing organic waste accumulation, improving rainwater infiltration, minimizing the risk of surface water stagnation, and strengthening community empowerment toward sustainable environmental management. Therefore, community-based biopore implementation can serve as an effective strategy to support sustainable waste management at the village level.

1. Introduction

Waste management remains one of the most pressing environmental challenges in achieving sustainable development across many countries, including Indonesia. Rapid population growth, urban expansion, changing consumption patterns, and increasing economic activities have significantly contributed to the continuous rise in municipal solid waste generation. This growing volume of waste poses a serious environmental concern when not supported by an effective and sustainable waste management system, as it can lead to soil, water, and air pollution while also increasing risks to public health. In recent years, waste management has evolved beyond the conventional practice of waste collection and disposal toward a more comprehensive and integrated approach that emphasizes waste reduction at the source, segregation, reuse, recycling, and environmentally sound final treatment. Therefore, strengthening collaboration among governments, academic institutions, and local communities is essential to developing an effective waste management system that promotes a cleaner, healthier, and more sustainable environment. (Nikmah, 2025) .

Waste management challenges in Indonesia are not solely attributable to the increasing volume of waste generated but are also closely associated with the low level of public awareness regarding proper waste management practices. Many households continue to dispose of organic and inorganic waste without prior separation, litter indiscriminately, and rely on open waste burning as a convenient method for reducing household waste. These practices have significant adverse effects on environmental quality, contributing to air pollution, accelerating ecosystem degradation, and increasing the risk of various environment-related diseases. Furthermore, inadequate waste management facilities and infrastructure at the village and sub-district levels hinder the effective collection, processing, and disposal of municipal waste. These conditions indicate that addressing waste management issues requires more than infrastructure development alone; it also necessitates sustained community education and empowerment programs to promote long-term behavioral change and encourage environmentally responsible waste management practices.

One of the approaches that has been widely promoted in waste management is the implementation of the Reduce, Reuse, and Recycle (3R) principle, which emphasizes minimizing waste generation at its source. This approach encourages communities to reduce the use of single-use products, reuse items that remain functional, and recycle waste into products with practical and economic value. The implementation of the 3R principle has been shown to effectively reduce the amount of waste disposed of in landfills while simultaneously fostering greater public awareness of environmental conservation. Nevertheless, the success of this approach largely depends on the level of public knowledge, environmental awareness, and active community participation in adopting more sustainable and environmentally responsible daily practices.

In addition to implementing the 3R principles, the adoption of appropriate technology represents an effective approach to strengthening community-based waste management. One of the most widely recommended technologies is the Biopore Infiltration Hole (BIH), a vertically drilled cylindrical hole in the soil that functions both as a medium for processing organic waste and as a means of enhancing rainwater infiltration. This technology offers several advantages, including its simple application, low implementation cost, and reliance on materials that are readily available within the local environment. Organic waste deposited into the biopore undergoes natural

decomposition, gradually producing compost that can be reused as organic fertilizer for plants. Consequently, the implementation of biopore infiltration holes not only reduces the volume of organic waste but also contributes to groundwater recharge, mitigates flood risk, and promotes long-term environmental sustainability.(Puspita et al., 2025) .

The successful implementation of biopore technology depends not only on technical aspects but also on active community participation throughout every stage of the program. Community empowerment through educational outreach, training, continuous assistance, and hands-on practice plays a crucial role in enhancing public knowledge while fostering environmentally responsible behavior. These activities enable community members to understand the importance of household waste segregation, the utilization of organic waste for compost production, and the sustainable maintenance of biopore infiltration holes. Strong community participation also promotes a sense of ownership toward the program, thereby increasing its effectiveness and ensuring its long-term sustainability.

Based on the community service report conducted in Sunggumanai Hamlet, Parangloe District, Gowa Regency, waste management remains one of the key issues requiring immediate attention (See Table 1). The assessment revealed that community awareness of waste segregation practices is still relatively low, supporting facilities for proper waste management are limited, and the practice of burning household waste is still common among residents. To address these challenges, a community-based intervention program was implemented through waste management education and the construction of Biopore Infiltration Holes (BIHs), providing a practical and easily applicable solution by utilizing locally available resources. In addition, the program introduced an innovative approach by using bamboo as a casing material for the biopores, making the construction process more cost-effective while maintaining the primary function of the biopore system.

Table 1. *Results of the Assessment of Priorities for Waste Management Issues*

Criteria	Score	Quantitative Analysis
Magnitude	44	Solid waste management issues are prevalent across nearly all neighborhood units (RTs) in Sunggumanai Hamlet, with mixed plastic and organic waste constituting the dominant types of waste.
Seriousness	43	The resulting impacts are considerable, including unpleasant odors, clogged drainage systems, and the potential for soil contamination.
Manageability	37	The issue has strong potential to be addressed through the utilization of locally available resources and simple, low-cost technologies, such as biopore infiltration holes.
Community Concern	31	Community awareness and environmental concern remain at a moderate level, indicating the need for appropriate intervention strategies to encourage greater public participation in waste management activities.
Total Score	155	Priority III (Flagship Physical Intervention)

The implementation of the community-based waste management program in Dusun Sunggumanai is expected to generate both immediate and long-term benefits for the local community. Educational activities focusing on waste segregation, the utilization of organic waste, and the construction of biopore infiltration holes are anticipated to enhance public awareness and encourage greater community participation in maintaining environmental cleanliness. Furthermore, the adoption of biopore technology is expected to reduce the amount of waste that is openly burned

or improperly disposed of, improve the soil's capacity to absorb rainwater, and produce organic compost that can be utilized to support agricultural activities and urban greening initiatives within the surrounding area. (Wulan, 2025) .

Based on the aforementioned issues, this study aims to examine the implementation of a community-based waste management program through the utilization of Biopore Infiltration Hole technology in Sunggumanai Hamlet, Parangloe District, Gowa Regency. The discussion focuses on the environmental challenges faced by the local community, the methods employed in implementing the program, the outcomes of its implementation, and the benefits achieved following its execution. This study is expected to serve as a valuable reference for government agencies, academics, and communities in developing participatory waste management programs that are simple, effective, cost-efficient, and sustainable. Furthermore, the findings may provide practical insights for implementing similar community-based waste management initiatives in other regions with comparable environmental challenges.

2. Method

This article employed a descriptive approach based on the outcomes of a community service program conducted in Sunggumanai Hamlet, Parangloe District, Gowa Regency, Indonesia. The descriptive approach was selected because it enables a systematic portrayal of the existing waste management conditions within the community, the implementation process of the program, and the outcomes achieved following its execution. The data were collected through field observations, problem identification, activity documentation, and reports generated during the community service program (see Table 2). Subsequently, all data were analyzed qualitatively to assess the effectiveness of a community-based waste management program through the implementation of Biopore Infiltration Holes (BIHs). This approach was expected to provide a comprehensive understanding of the program implementation while serving as a basis for evaluating its contribution to improving environmental quality and enhancing community participation. (Innuddin et al., 2023) .

The implementation of the program began with a preparatory phase aimed at ensuring that all activities were systematically organized and aligned with the needs of the local community. During this stage, coordination was carried out with the village government, hamlet leaders, and community representatives to determine the implementation site and identify the primary target participants. In addition, the project team conducted a preliminary assessment of the community's solid waste management challenges through field surveys. Based on the findings, educational materials were developed covering source-based waste management practices, the principles of the 3Rs (Reduce, Reuse, and Recycle), and the use of Biopore Infiltration Holes as an alternative method for managing organic waste. The team also prepared all necessary equipment and materials, including soil augers, measuring tools, bamboo sleeves for the biopore holes, and educational media, to ensure that the program could be implemented effectively and efficiently.

The implementation phase was carried out through community-based educational sessions, demonstrations, and hands-on practical activities. The educational sessions were delivered interactively by providing information on the negative impacts of improper waste management, the importance of household waste segregation at the source, and the environmental benefits of

implementing biopore infiltration technology. Following the presentation, community members participated in a guided practical session on constructing Biopore Infiltration Holes (BIHs) under the supervision of the project team. The practical activities included selecting appropriate locations, drilling the soil according to the recommended dimensions, installing bamboo casings, and filling the biopore holes with organic waste. This hands-on approach was adopted to ensure that participants not only gained a theoretical understanding of biopore technology but also developed the practical skills and confidence needed to implement it independently within their residential communities.

In addition to educational sessions and hands-on practice, continuous assistance was provided throughout the program implementation to ensure that each stage was carried out in accordance with the established objectives. This assistance included observing community participation, providing guidance whenever challenges arose during practical activities, and documenting the entire implementation process for evaluation purposes. The documentation served to assess the level of community engagement, the effectiveness of program implementation, and the various supporting and inhibiting factors encountered throughout the activities. Through continuous mentoring and monitoring, it was expected that community members would develop a sustained understanding of the importance of consistently practicing waste segregation, utilizing biopore infiltration holes, and adopting clean and healthy living behaviors as integral components of environmental conservation efforts.(Ayu & Winanda, 2020) .

The data collected throughout the implementation of the program were analyzed using a qualitative descriptive approach. The analysis focused on describing the initial conditions of waste management at the project site, the implementation process of the program, the level of community participation, and the changes observed following the intervention. Information obtained from observations, documentation, and other relevant sources during the program implementation was then compared with established concepts of community-based waste management reported in the scientific literature. This approach enabled the authors to provide a comprehensive evaluation of the program's effectiveness without employing statistical analysis, thereby emphasizing the interpretation of the implementation process and the outcomes achieved.

Through a systematic methodological framework encompassing the preparation, implementation, mentoring, and data analysis phases, this community engagement program is expected to generate comprehensive insights into the implementation of community-based solid waste management through the application of Biopore Infiltration Hole technology. The adopted approach is designed not only to address environmental issues in the short term but also to foster environmental awareness, enhance community knowledge, and strengthen local capacity for sustainable waste management. Consequently, the outcomes of this program are expected to serve as a practical model for the application of appropriate technology that can be readily replicated in other areas facing similar solid waste management challenges.

Table 2. Activity Documentation

Activity Documentation		Description
1		The process of making biopore holes utilizes local bamboo, a natural asset sourced from the surrounding hamlets. The bamboo is cut and perforated as a more economical and environmentally friendly alternative to PVC pipes.
2		Introduction of Molasses and EM4 Liquids for Biopores. Educational outreach regarding the utilization of bioactivators to speed up the decomposition process of organic waste within biopore holes.
3		Installation of the biopore casing into the ground. The bamboo casing is inserted into the drilled hole, ready to be used for collecting household organic waste.
4		Counseling and Advocacy by Facilitators on Waste Management and Segregation Issues, and the Introduction of the 'SAJADAH EMAS' Program to Community Leaders and Local Residents.

3. Results & Discussion

3.1 Identification of Solid Waste Management Issues in Sunggumanai Hamlet

The field assessment revealed that solid waste management in Sunggumanai Hamlet continues to face several significant challenges that require immediate attention. Based on field observations and problem prioritization using the Bryant Method, inadequate solid waste management was identified as one of the primary issues due to its substantial impact on environmental quality and public health. The main problems include the low level of community awareness regarding waste segregation at the source, the limited availability of supporting waste management facilities, and the persistent practice of open burning of household waste and indiscriminate disposal of waste in open areas. These conditions have the potential to contribute to environmental pollution, deteriorate sanitation conditions within the settlement, and increase the risk of environmentally related diseases. Therefore, a comprehensive intervention is needed that not only focuses on improving waste

management infrastructure but also enhances community knowledge and promotes sustainable behavioral changes in solid waste management practices. (Firdaus & Ikhlas, 2025) .

Based on the results of the Bryant Method analysis, waste management obtained a total score of 155 and was identified as the third priority for the community service program. The prioritization was conducted using four key criteria: magnitude of the problem, seriousness of its impacts, manageability, and the level of community concern. Although several other issues received higher overall scores, waste management was selected as the primary focus of the intervention because of its long-term implications for environmental quality and its feasibility to be addressed through the utilization of locally available resources and appropriate low-cost technologies. Establishing priorities through a systematic assessment provides a robust basis for determining the most suitable intervention strategies according to the community's needs and local conditions, thereby enhancing the effectiveness and relevance of the program implementation.

Root cause analysis using the Fishbone Diagram approach revealed that the low quality of waste management is influenced by multiple interrelated factors. Human-related factors include limited public knowledge of the Reduce, Reuse, and Recycle (3R) concept, inadequate waste segregation practices, and insufficient awareness of the adverse health impacts associated with open waste burning. From the methodological perspective, the absence of a structured household waste management system has left communities without clear guidelines for waste segregation and processing. Environmental factors also contribute significantly, particularly the lack of adequate waste disposal facilities. In addition, infrastructural limitations, including the insufficient availability of waste bins and waste collection services, further hinder effective waste management. These findings indicate that addressing waste management challenges requires a comprehensive approach that integrates community capacity building, the provision of adequate supporting infrastructure, and the implementation of practical technologies that can be readily adopted by local communities. (Ramadhani & Winardini, 2024) .

Based on the identified problems and the root cause analysis, the community service program was designed to empower the local community through educational initiatives on solid waste management and the implementation of Biopore Infiltration Holes (BIHs). This approach was selected because it effectively addresses the key underlying factors identified during the assessment, particularly by enhancing community knowledge, encouraging positive behavioral change, and providing a simple, cost-effective, and environmentally friendly method for managing organic waste. In addition to reducing the volume of organic waste, the implementation of BIHs contributes to improving rainwater infiltration, minimizing the risk of surface runoff and flooding, and converting organic waste into valuable compost. Therefore, the findings from the problem identification and root cause analysis served as a fundamental basis for designing intervention strategies that are responsive to community needs while promoting more sustainable environmental management.

3.2 Implementation of the SAJADAH EMAS Program

The implementation of the SAJADAH EMAS program (Community Education and Facilitation for Waste Management, Waste Segregation, and Biopore Infiltration Hole Construction) was designed as an intervention based on the findings of the preliminary needs assessment. The program

aimed to enhance community knowledge, awareness, and practical skills in managing household waste independently through an integrated approach combining educational activities with hands-on practice. The program began with coordination meetings involving the village government, hamlet leaders, and community representatives to secure institutional support and determine the target participants. This participatory approach served as a crucial initial step, as the success of community empowerment initiatives largely depends on the active engagement of all stakeholders throughout the planning, implementation, and evaluation phases of the program. (Asdin et al., 2023).

Following the coordination phase, the program proceeded with an educational session emphasizing the importance of source-based waste management, the implementation of the Reduce, Reuse, and Recycle (3R) principles, and the utilization of Biopore Infiltration Holes as an alternative method for processing organic waste. The educational materials were delivered through an interactive approach, enabling participants not only to acquire theoretical knowledge but also to engage in discussions regarding the waste management challenges they encounter in their daily lives. The use of clear and accessible language, supported by practical examples, enhanced participants' understanding of the relationship between improper waste disposal practices and their adverse impacts on both public health and the environment. Furthermore, the educational session served as an effective platform for fostering public awareness that waste management is a shared responsibility requiring active participation from all members of the community, rather than being solely the responsibility of the government.

The next stage involved a hands-on demonstration of constructing Biopore Infiltration Holes (BIHs) at several selected households that served as pilot sites. Community members were guided through each step of the process, including selecting appropriate locations, drilling the soil according to the recommended dimensions, installing bamboo sleeves, and filling the biopore holes with organic waste. The use of bamboo as an alternative to PVC pipes represented an innovative approach that utilized locally available resources, thereby reducing construction costs and making the technology more accessible and practical for the community. Through this direct practical experience, participants gained the knowledge and skills required to construct and maintain biopore infiltration holes, enabling them to implement the technology independently in their own residential environments. (Kusnadi, 2017).

The implementation of the SAJADAH EMAS program demonstrated that an educational approach combined with hands-on activities effectively enhanced community enthusiasm and participation throughout the entire program. The active involvement of community leaders, housewives, and village youth reflected strong social support for the initiative. In addition to improving public knowledge of sustainable waste management practices, the program strengthened collaboration among community members in maintaining environmental cleanliness. The successful implementation of the program indicates that community-based waste management is more effective when carried out through a participatory approach that actively engages local residents as key actors rather than merely as beneficiaries.

3.3 Effectiveness of Biopore Implementation and Community Participation

The results of the program implementation indicate that the application of Biopore Infiltration Holes (BIHs) has made a significant contribution to household organic waste management. Community members gradually recognized that organic waste, such as food scraps, dried leaves, and vegetable residues, should not simply be burned or discarded. Instead, these materials can be utilized as compost through the biopore system. This shift in understanding serves as an important indicator that the educational activities successfully enhanced public knowledge and awareness of environmentally sustainable waste management practices. Furthermore, the implementation of biopores offers a practical and accessible solution, as it requires neither sophisticated technology nor substantial financial investment, making it suitable for widespread adoption at the household level. (Nurhaliza et al., 2025) .

Enhancing the soil's capacity to absorb rainwater. Organic waste deposited into the biopore undergoes natural decomposition, creating interconnected pore spaces within the soil through the activity of soil organisms. This process improves the soil's infiltration capacity, thereby reducing surface runoff and waterlogging while contributing to the replenishment of groundwater reserves. Consequently, the implementation of biopore technology not only addresses the challenge of organic waste management but also supports long-term environmental conservation and promotes sustainable natural resource management.

Community participation was a key factor contributing to the successful implementation of the program. The active involvement of local residents in educational sessions, hands-on biopore infiltration hole construction, and their commitment to initiating household waste segregation reflected a positive behavioral change following the intervention. The participation of housewives in sorting household waste at its source, particularly in the kitchen, together with the involvement of village youth in constructing biopore infiltration holes, demonstrated that waste management can be effectively implemented through collaborative efforts among all segments of the community. These findings indicate that a community empowerment approach can strengthen collective responsibility and encourage sustained public engagement in maintaining environmental cleanliness. (Urahmah et al., 2024).

3.4 Challenges and Sustainability Efforts in the Waste Management Program

Although the implementation of the waste management program through the application of biopore infiltration holes has produced encouraging outcomes, several challenges remain that must be addressed to ensure its long-term sustainability. These challenges include unfavorable environmental conditions, limited supporting facilities and resources, and the need to maintain community commitment to newly adopted waste segregation and management practices. In several areas, hard and rocky soil conditions made the construction of biopore infiltration holes more labor-intensive and time-consuming than in locations with softer, more fertile soil. Furthermore, not all community members possess the necessary knowledge and practical skills to maintain the biopore systems effectively. Therefore, continuous guidance, technical assistance, and community engagement are essential to ensure that the environmental and social benefits of the program can be sustained over the long term. (Kurniawan & Abdillah, 2024) .

To address these challenges, the implementation team adopted several practical solutions tailored to the local field conditions. One of the primary measures involved moistening the soil prior to drilling, which softened the ground and facilitated the installation of the biopore infiltration holes. In addition, the use of bamboo as a casing material for the biopore holes represented an innovative and cost-effective approach that maximized the utilization of locally available resources in Sunggumanai Hamlet. This strategy demonstrated that limited resources do not necessarily constitute a major obstacle when communities are able to optimize their local potential. Furthermore, this simple innovation encouraged greater community participation by motivating residents to construct biopore infiltration holes independently, as the required materials were inexpensive, readily available, and easy to use.

The sustainability of the program largely depends on the community's commitment to consistently implementing proper waste management practices after the community service activities have been completed. The biopore infiltration holes that have been established should continue to be utilized for processing organic waste through regular filling and periodic compost harvesting once the holes reach their capacity. In addition, waste segregation at the household level should become a daily practice to continuously reduce the amount of waste that is disposed of or burned. Therefore, ongoing support from the village government, community health volunteers, and local community leaders is essential to provide regular guidance and monitoring, ensuring that the program continues to develop and delivers long-term environmental and social benefits. (Martadinata et al., 2025) .

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5. Implications of the Program for Sustainable Environmental Management

The implementation of a community-based waste management program through the application of Biopore Infiltration Holes has generated a range of positive impacts on environmental conservation efforts. Rather than merely addressing short-term waste problems, the program also fosters public awareness of the importance of maintaining environmental balance through responsible waste management practices. The educational activities conducted during the program have improved community understanding of the relationship between waste disposal behaviors and environmental quality, public health, and the sustainability of natural resources. This shift in mindset serves as a crucial foundation for cultivating a long-term, environmentally conscious culture within the community. (Kusnadi, 2017) .

The utilization of Biopore Infiltration Holes as a medium for organic waste processing provides multiple benefits to the community. In addition to reducing the volume of organic waste disposed of into the environment, this technology also enhances soil water infiltration capacity, thereby helping to mitigate the risk of waterlogging and flooding during the rainy season. Organic waste decomposed within biopore holes undergoes a natural decomposition process that produces compost, which can be used as an organic fertilizer for plants. Consequently, the community gains both economic and environmental benefits from waste that was previously considered worthless.

The success of the program underscores that community empowerment is an effective strategy for promoting sustainable environmental development. Active community participation throughout

all stages of the activities fosters a strong sense of ownership, which in turn encourages residents to maintain and sustain the outcomes that have been achieved. The synergy among the local community, village government, academics, and field facilitators plays a crucial role in establishing a self-sustaining waste management system. Such a collaborative model can serve as a best practice for other villages facing similar challenges in waste management.(Erfain, 2025) .

Based on the overall implementation results, it can be concluded that the waste management program through education, mentoring, and the application of biopore infiltration technology has had a positive impact on improving environmental quality as well as empowering the community. The program demonstrates that simple, locally applicable technologies, when supported by active community participation, can serve as an effective solution to reduce household waste-related problems. Therefore, the continuous development of similar programs should be encouraged through stronger government policy support, enhanced community capacity building, and multi-stakeholder collaboration, so that the benefits generated can be experienced more broadly and sustainably.

4. Conclusion

The implementation of a community-based waste management program through the application of Biopore Infiltration Holes (BIH) in Sunggumanai Hamlet, Parangloe District, Gowa Regency, demonstrates that an approach combining community empowerment with appropriate technology can serve as an effective solution to household waste management issues. Based on the problem identification, it was found that low public awareness of waste sorting, limited waste management facilities, and the continued practice of waste burning are the main factors contributing to suboptimal waste management. Through the SAJADAH EMAS program, which includes outreach activities, hands-on assistance, and practical training in constructing Biopore Infiltration Holes, there has been a notable improvement in community knowledge, skills, and participation in managing organic waste in a more environmentally friendly manner. The innovation of using bamboo as a biopore casing also demonstrates that the utilization of local resources can produce a technology that is more economical, easy to apply, and still effective in supporting waste management and groundwater conservation. In addition to reducing the volume of organic waste, this program contributes to improving environmental quality, strengthening community cooperation, and fostering more environmentally responsible behavior. Therefore, the implementation of community-based waste management through Biopore Infiltration Hole technology is worthy of being developed sustainably as a strategy to create a clean, healthy, and sustainable environment at the village level and in other areas with similar characteristics of waste management challenges.

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