ENHANCING HOUSEHOLD WASTE MANAGEMENT FOR CLIMATE CHANGE MITIGATION: A CASE STUDY OF RW 06, PASIRLUYU, BANDUNG, INDONESIA

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Abstract

In exploring how household waste management contributes positively towards climate change mitigation in RW (sub hamlet) 06, Pasirluyu Sub District, Bandung, the objective of this study is to assess existing waste management practices; promoted community awareness as well as aligning them with climate actions like waste reduction programs through recycling and composting initiatives. Recommendation is suggested for enhancing household waste management, especially facing the climate change mitigation. A total of 10 representative households were followed for 30 days collecting data on their wastes generation, separation and treatment processes that included various types of waste such as organic, inorganic and residual where organic wastes were composted using a Takakura method. The findings reveal that between 40-60% of the total amount of household garbage are made up of organic substances while inorganic substances account for about 20-35% and lastly residuals constitute only 5-10%. Households managed to separate their wastes properly on one hand though on another incorrect sorting was noted complicated by inconsistent participation. Thus composting resulted into reduced amounts of organic waste going to landfills thereby minimizing methane emissions. But then again limited infrastructural facilities as well as low levels of understanding were some other barriers against enforcing these practices. Continuous community engagement, enhanced infrastructure, and policy support are essential for aligning waste management with climate change mitigation efforts in RW 06. The findings contribute to broader sustainability goals and highlight the potential for similar urban communities to adopt climate-conscious waste management practices.

Keywords: *waste management, climate change mitigation, composting, recycling, community engagement*

Introduction

Waste management in Indonesia is categorized into two major types, i.e. household waste management and specific waste management (Aprilia, Tezuka, & Spaargaren, 2013). While specific waste management is under the responsibility of the government, household waste management involves activities such as waste reduction, recycling, and reuse (Wulandari, Soemarno, & Koderi, 2021) (Martitah, Sulistianingsih, Sumarto, & Adhi, 2024) (Mahartin, 2023). Various stakeholders, including central and local governments, businesses, and the general public, play a critical role in managing household waste (Safitri, Ariyaningsih, & Shaw, 2024) (Agustang, Hairuddin, Agustang, & Yulis, 2023). Proper waste management, especially at the household level, is essential for reducing the volume of waste that ends up in landfills (Fadhullah, Imran,

Ismail, Jaafar, & Abdullah, 2022) (Jouhara, et al., 2017).

The recent fire at the Sarimukti landfill has underscored the importance of effective waste management. The fire caused a temporary closure of the landfill, leading to an overload at temporary waste storage facilities (TPS) across Bandung. This event has created a waste emergency in Bandung, demonstrating the need for waste management starting from households. By properly managing waste at its source, the amount of waste transported to the landfill could be reduced, preventing future overloads when the landfill resumes operations(Rachman, Soesanto, Khair, & Matsumoto, 2020).

RW (sub hamlet) 06 in Pasirluyu Sub District, Regol District, Bandung, produces significant amounts of household waste. To address this, the community has initiated a waste management program involving activities such as waste separation, packaging, and collection. This initiative is part of the effort to develop a Climate Village Program (ProKlim) in RW 06. The program aims to reduce waste generation and raise community awareness about waste management at the source, fostering more sustainable waste practices.

The waste management efforts in RW 06 have been supported by community engagement and monitoring activities. The goal is to assess existing conditions and improve awareness of waste management among residents. The involvement of the community is crucial in ensuring the success of the waste management program, as it empowers residents to take responsibility for reducing and handling their waste. The initiative in RW 06 represents a critical step towards sustainable waste management in Bandung. By reducing waste generation at the household level, the community is contributing to broader environmental goals. This program not only addresses immediate waste disposal challenges but also promotes long-term environmental

sustainability. As more communities adopt similar practices, Bandung can move towards a cleaner, more sustainable future, reducing its reliance on landfills and mitigating the risks of waste emergencies.

Research Methodology

Research Location

The study was conducted in RW (sub hamlet) 06, Pasirluyu Sub District, Regol District, Bandung City, Indonesia, specifically focusing on household waste management. This area was selected due to its ongoing efforts to implement a Climate Village Program (ProKlim) and its waste management challenges following the Sarimukti landfill closure. The study aims to assist in the monitoring and mentoring of waste management activities, targeting improvements in the awareness and practices of local residents. Figure 1 shows the map of Pasirluyu Sub District. There are 9 RW (sub hamlet) in the Pasirluyu Sub District/ Village. Figure 2 shows in detail of RW 06 with 5 RT (sub sub hamlet), the smallest neighborhood association.
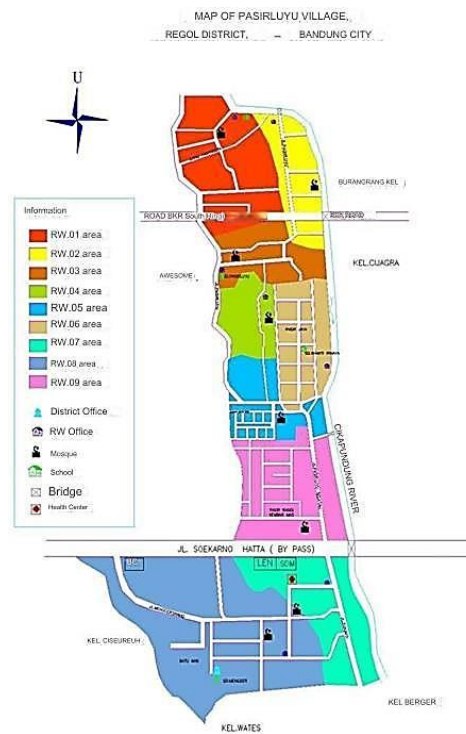

Figure 1. Map of Pasirluyu Sub District.

Figure 2. Map of RW 06

Sample Selection

A total of 10 representative households from RW 06 were selected for the study. These households were chosen based on recommendations from the local community leader (RW head) and represented each sub-neighborhood (RT) within RW 06. The households were intended to serve as models for waste management practices, allowing for the collection of detailed data on waste generation, separation, and treatment. Table 1 shows the number of person on each household sample.

Table 1. Number of Person in Household Sample

No	Household Code	Number of person
1	A	8
2	B	5
3	C	3
4	D	5
5	E	3
6	F	5
7	G	5
8	H	2
9	I	5
10	J	5

Data Collection Techniques

Data collection involved a 30-day observation period during which waste generation from the 10 selected households was monitored. The waste was classified into three categories: organic, inorganic, and residual waste. The study aimed to assess the quantity and type of waste produced daily by each household. In addition to direct observation, data on community involvement and waste management practices were collected through interviews with household members and local waste collectors. Information on the type and volume of waste was recorded daily to understand the patterns of waste generation and management.

Waste Management Process

The study emphasized waste management steps, including waste separation at the source, collection, and treatment. Households were instructed to separate waste into organic, inorganic, and residual categories. Organic waste was composted using the Takakura method, a simple home composting technique suitable for small-scale applications. Inorganic waste was either recycled or collected by local waste collectors. Residual waste, which could not be processed, was transported to the local waste storage facility (TPS). Monitoring was done to assess the effectiveness of this process and identify any issues, such as improper separation or composting problems.

Data Analysis

The data gathered from the households was analyzed to assess the effectiveness of waste management practices. Key metrics included the volume of waste reduced, the success of waste separation, and the participation levels of the households. Statistical analysis was performed to compare waste generation before and after the intervention. The study also evaluated the impact of mentoring and monitoring on household behavior, examining whether waste reduction practices became more consistent over time. Challenges such as incorrect waste

separation, composting errors, and participation gaps were identified and addressed through continuous community engagement and support.

Result and Discussion

Waste Generation in RW 06

Data collected from 10 representative households in RW 06 during the 30-day observation period revealed a varied pattern of waste generation. The total waste produced was categorized into organic, inorganic, and residual waste. Organic waste constituted the largest proportion, generated mainly from household food scraps and gardening activities. The average waste generation per household ranged from 0.44 kg/day to 1.67 kg/day, with some households exceeding the national standard for waste generation of 3 liters per person per day (SNI 3242-2008).

The type of waste showed:
- Organic waste: 40-60% of total household waste.
- Inorganic waste: 20-35%, primarily consisting of plastic and packaging materials.
- Residual waste: 5-10%, including non-recyclable items such as diapers and used batteries.

Waste Separation Efficiency

Most households showed partial success in separating waste at the source. Households could easily identify and separate organic and inorganic waste, with organic waste often being composted. However, there were notable challenges in the accurate categorization of residual waste, as improper sorting was observed in a significant number of households. For instance, plastic wrappers and other recyclable materials were often mixed with residual waste, reducing the potential for effective recycling.

Figure 3. Waste Separation and Treatment Bins

Composting with Takakura Method

The Takakura method was implemented for composting organic waste in the households. The results indicated that this method was feasible and effective, with compost generated in approximately 30 days. However, some households faced difficulties in maintaining the appropriate conditions for composting, such as the proper moisture level and regular mixing. Inadequate aeration led to some compost becoming too wet or emitting unpleasant odors. Households that followed the correct procedure produced high-quality compost that was used for local gardening.

Figure 4. Composting using Takakura Method

Community Participation and Waste Management Challenges

While community participation was initially high due to active monitoring and mentoring, maintaining consistent engagement became a challenge. Several households did not adhere to the composting and waste separation guidelines after the initial phases of the project. Additionally, limited resources and knowledge gaps resulted in inconsistent practices, such as excessive use of composting starter (EM4) or insufficient waste segregation. The lack of adequate infrastructure for waste collection also posed a barrier, with some households struggling to manage the collection of residual waste due to limited transportation facilities.

Discussion

Waste Generation and Management Practices

The results demonstrate that organic waste forms a significant portion of household waste in RW 06, consistent with typical waste composition in urban areas of Indonesia. The successful separation and composting of organic waste suggest that households can reduce their overall waste volume when provided with proper guidance and resources. However, the high proportion of inorganic and residual waste indicates that more effort is needed in recycling and reducing non-biodegradable waste streams.

The variation in waste generation among households highlights the influence of household size and consumption patterns on waste production. Larger households tend to produce more waste, but even smaller households could exceed the standard limits, emphasizing the need for targeted awareness programs on reducing waste at the source.

Effectiveness of the Takakura Composting Method

The use of the Takakura composting method was largely effective in reducing organic waste. The method's low-cost and minimal resource requirements make it an appropriate solution for small-scale waste management in urban settings. However, the challenges faced by some households in maintaining proper composting conditions suggest that additional training and ongoing support are necessary for sustained success. The issues of odor and excessive moisture in some compost piles point to inadequate aeration and poor process management, which can be addressed through periodic community workshops.

Figure 5. Composting Monitoring

Community Involvement and Sustainability

The success of the waste management initiative in RW 06 relies heavily on consistent community participation. Initial results were promising, but the decline in engagement over time raises concerns about the sustainability of the program. To ensure long-term success, there needs to be continuous monitoring and community incentives. Strategies such as the introduction of waste banks, where households can exchange recyclable materials for money or goods, could increase participation and provide a financial incentive for proper waste management.

Furthermore, the study highlights the need for better infrastructure to support household-level waste management. This includes improving the availability of waste collection services and providing adequate facilities for recycling and composting.

Implications for Broader Waste Management Policies

The findings from RW 06 align with the broader challenges faced by many urban areas in

Indonesia, where limited infrastructure and low public awareness hinder effective waste management. The study demonstrates that with appropriate education and infrastructure, communities can significantly reduce their waste output and contribute to broader environmental goals, such as the Climate Village Program.

However, the persistent issues of non-recyclable residual waste and the improper disposal of hazardous materials indicate that government policies must evolve to provide clearer guidelines and support for waste management at the local level. This could include stricter regulations on waste separation, enhanced recycling programs, and the establishment of composting hubs to handle organic waste on a larger scale.

Recommendation

To align the waste management practices in RW 06, Pasirluyu Sub District, with climate change mitigation, a strategic approach must be adopted, focusing on reducing greenhouse gas (GHG) emissions and enhancing environmental sustainability. Here's an 8-paragraph scientific framework for integrating waste management with climate change mitigation:

Reduction of Organic Waste through Composting

Organic waste, which constitutes a significant portion of household waste in RW 06, plays a critical role in GHG emissions due to methane production in landfills. By enhancing the use of the Takakura composting method, the community can divert organic waste from landfills, reducing methane emissions, a potent GHG with 28-36 times the global warming potential of CO_2 over a 100-year period. Composting organic waste not only mitigates GHG emissions but also generates a valuable byproduct, compost, which can improve soil health and carbon sequestration when used in agriculture or local gardens.

Promotion of Waste Separation at the Source

Accurate waste separation is essential for reducing the volume of waste sent to landfills, where improper waste management contributes to GHG emissions. The community needs to be encouraged to sort waste into organic, inorganic, and residual categories effectively. This practice enables more efficient recycling of materials such as plastics, metals, and glass, reducing the need for raw material extraction, which is energy-intensive and leads to increased carbon emissions. By improving separation at the household level, RW 06 can significantly reduce the carbon footprint associated with waste disposal and material production.

Increased Recycling and Circular Economy Practices

Aligning waste management with climate change mitigation requires a strong emphasis on recycling and reusing materials to foster a circular economy. Recycling reduces the demand for virgin materials and the energy-intensive processes required to produce them. For RW 06, establishing or enhancing connections with waste banks and local recycling facilities can facilitate the collection and processing of recyclable materials. Encouraging households to participate in recycling not only reduces waste but also lowers GHG emissions from the production and disposal of new materials. Additionally, incentivizing recycling through monetary or community rewards can boost participation.

Reduction of Residual and Hazardous Waste

Residual and hazardous waste, such as diapers, batteries, and chemical-containing products, pose a significant environmental and climate change challenge due to their difficulty in recycling or disposal. These materials often end up in landfills, contributing to leachate and GHG emissions. To mitigate this, community awareness programs should focus on minimizing the use of non-recyclable products and properly

handling hazardous materials. Promoting alternatives to disposable products, such as reusable diapers or rechargeable batteries, can further reduce the environmental impact of residual waste.

Improved Waste Collection and Transport Efficiency

Waste collection and transport are crucial stages where GHG emissions can be mitigated. The existing system in RW 06, which relies on manual collection with carts, could be optimized by increasing the efficiency of waste transport routes and minimizing unnecessary trips. By introducing green waste management technologies, such as electric vehicles or bicycles for waste collection, the community can further reduce fuel consumption and emissions. Additionally, ensuring that waste is separated and processed at the source reduces the volume of waste requiring transportation, which directly lowers emissions associated with fuel usage.

Community Engagement and Education on Climate Change

A crucial aspect of aligning waste management with climate change mitigation is fostering community awareness and participation. The residents of RW 06 need to understand the connection between waste management and climate change, including how improper waste disposal contributes to GHG emissions. Education campaigns, workshops, and continuous monitoring can help maintain high levels of participation in composting, recycling, and waste separation efforts. Empowering community members to take action against climate change through their waste management practices can also encourage behavior change in other areas, such as energy conservation and sustainable consumption.

Policy Advocacy and Long-Term Sustainability Planning

Aligning waste management practices with climate change mitigation requires not only community action but also supportive policies and regulations at the municipal and national levels. Advocacy for stricter waste management regulations, such as mandatory recycling laws or bans on single-use plastics, will reinforce efforts made at the community level. Additionally, long-term sustainability planning for RW 06 should include periodic evaluations of the waste management program's effectiveness in reducing GHG emissions.

Conclusions

The study conducted in RW 06, Pasirluyu Sub District, demonstrates the potential for effective waste management to contribute significantly to climate change mitigation efforts. The implementation of waste separation, composting using the Takakura method, and recycling practices has led to a reduction in the volume of waste sent to landfills. This, in turn, minimizes methane emissions from organic waste decomposition in landfills, which is a potent contributor to global warming. Although the program faced challenges, such as inconsistent community participation and issues with composting practices, the overall impact indicates that with proper education and infrastructure, waste management can be an integral part of climate action at the community level.

To align more closely with climate change mitigation, RW 06 must focus on reducing greenhouse gas emissions by enhancing organic waste composting, increasing recycling rates, and minimizing residual waste. The integration of waste management with circular economy principles—such as reducing, reusing, and recycling materials—will further decrease the environmental footprint of the community. In addition, improving waste transport efficiency and promoting the use of renewable energy in waste processing will contribute to a lower carbon footprint.

The study underscores the importance of community involvement in achieving sustainable waste management practices that are aligned with climate change mitigation goals. Continued education, policy support, and innovative solutions, such as waste-to-energy technologies, can ensure that RW 06 not only manages waste effectively but also plays an active role in reducing the community's impact on the climate.

Acknowledgement

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