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Supervision of Structured Waste Management System Based on Separate Collection Scheme as Strategy for Economic Empowerment of The Community of Melong Village, Cimahi City

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Abstract

The increasing volume of waste in Cimahi City has become an environmental and socio-economic challenge that demands sustainable and community-based management. This community service project aims to strengthen environmental awareness and economic empowerment through the implementation of a Structured Waste Management Monitoring System based on the Separate Collection Scheme (SKP) and the 4R principles (Replace, Reduce, Reuse, Recycle) in RW 07, Melong Village. The program uses a participatory approach that combines field surveys, workshops, and mentoring involving local residents, academics, and government representatives. Activities began with a situation analysis and coordination with the Melong Village Government, followed by educational sessions and practical demonstrations on waste sorting, recycling, and monitoring practices. Pre-test and post-test assessments showed a significant increase in residents' understanding of waste classification, monitoring mechanisms, and sustainable waste management practices. The implementation of the SKP model successfully drove behavioral change, fostered collective responsibility, and reduced dependence on municipal waste services. Furthermore, this initiative generated socio-economic benefits by motivating residents to develop recycling-based entrepreneurship such as waste banks, composting, and creative recycled products. The research findings demonstrate that integrated environmental education and participatory monitoring can effectively drive community transformation toward sustainability. Collaboration between academics, local government, and the community has resulted in a replicable model for structured, community-based waste management that contributes to environmental protection and economic resilience. In conclusion, this program not only addresses the local waste crisis but also lays the foundation for a circular economy framework at the village level, supporting Cimahi City's vision for a clean, resilient, and sustainable urban ecosystem.

Keywords: Community empowerment, separate collection scheme, waste management, circular economy, Cimahi City

1. Introduction

The waste problem is a growing issue that requires sustainable management, given that waste is a byproduct of various community activities, including residential, commercial, and industrial activities (Awuchi et al., 2020). Cimahi City is currently facing a waste emergency that requires serious attention from various parties. The volume of waste generated daily continues to increase in line with population growth and economic activity, but this increase is not matched by an optimal management system, including infrastructure, public education, and the active involvement of all city elements (Febriani, 2025). This situation is exacerbated by the limited capacity of Final Disposal Sites (TPA) and low public awareness of waste sorting and reduction at the source. As a result, household waste, market waste, and even small-scale industrial waste continue to accumulate, causing various impacts, ranging from environmental pollution and the spread of disease to a reduced quality of life for Cimahi residents.

According to Siddiqua et al. (2022), environmental pollution due to waste accumulation can lead to a decline in environmental quality and impact human health. One of the main causes is the hazardous and toxic materials (B3) contained in waste. A similar situation also occurs in RW 07, Melong Village, Cimahi City, where high levels of community economic activity generate significant amounts of waste. According to Ngatiyana (2025), as quoted in Jaya (2025), the Mayor of Cimahi, the accumulation of waste is caused by declining management at the household level and limited waste quotas at the Sarimukti Landfill in West Bandung. This has resulted in several TPSs being overcapacity,

triggering air pollution, clogged waterways, and increasing the potential for disease transmission. As an emergency response, the Cimahi City Government held a mass cleanup from April 21–27, 2025 (Krisiandi, 2025). This policy provides a crucial opportunity to strengthen collaboration between the government, environmental communities, the business world, and the wider community in realizing a sustainable waste management system.

Figure 1: Piles of waste at the cibeber landfill, Cimahi City. Source: (Krisiandi, 2025)

Public awareness and participation in waste management are key to creating a clean, healthy, and green environment. However, data shows that the level of public participation in waste management remains low. Based on the Improvement of Solid Waste Management to Support Regional Area and Metropolitan Cities (ISWMP), waste collection effectiveness in Cimahi City (78.75%) is considered good, but only 3.29% of waste is processed, far below Bandung City's 11.61% (Pratama, 2024). This imbalance indicates the absence of an organized, measurable waste management program that provides added economic value to the community. Conventional waste management actually triggers environmental pollution that can threaten residents' health. Therefore, an integrated effort is needed that involves education and community empowerment through waste sorting activities at the source.

Figure 2: Percentage of waste transported and processed in the bandung basin area based on 2020 ISWMP Project data. Source: (Pratama, 2024)

Sorting allows organic waste to be processed into compost, while recyclable inorganic waste can be reused, reducing the amount of waste sent to landfills. However, problems arise when oversight of the transportation and sorting process is suboptimal. This was confirmed by Ida, a customer at the Cimahi Antri Market, who complained about the pungent odor caused by the piles of garbage around the market area (Pratiwi, 2025). This situation highlights the need for a better waste collection system to prevent environmental pollution.

One scheme that can be implemented to optimize waste management oversight is the Separate Collection Scheme (SCS), which separates organic and inorganic waste. According to Gallardo et al. (2021), implementing SCS can provide quality raw materials for fertilizer production and reduce greenhouse gas emissions. A study by Schüch et al. (2016) in Germany also showed that separate collection can reduce residual waste volume by up to 30% and increase processing efficiency. Meanwhile, Bees & Williams (2017) reported that the implementation of SCS in Southampton, England, saved up to £690,000 per year, despite requiring a substantial initial investment for infrastructure adaptation.

This separate waste management scheme also aligns with the 4R principles (Replace, Reduce, Reuse, and Recycle) as stipulated in the Minister of Public Works Regulation No. 03 of 2013 concerning Waste Management at TPS3R. According to Sadono (2024), the existence of TPS3R can reduce the amount of waste generated and the burden on landfills, as well as open up opportunities for processing waste into new economic sources. In this context, community empowerment is a strategic factor in encouraging the creation of a circular economy. As Harahap and Muhamad (2024)

noted, processing household waste into high-value products can increase community income and strengthen local economic resilience.

These conditions emphasize the importance of this community service activity, which focuses on implementing the Separate Collection Scheme in RW 07, Melong Village, Cimahi City. This program aims to increase community awareness and capacity in managing waste from its source through education, mentoring, and the establishment of an effective monitoring system. Through this approach, the team strives to create structured, sustainable, and well-monitored waste management at the household, market, and small business levels. Furthermore, this activity is designed to encourage community economic empowerment by converting waste into valuable products, such as compost from organic waste and crafts from inorganic waste. Through the formation of independent and productive waste processing groups, it is hoped that the community will be able to transform from mere waste producers to empowered and environmentally conscious circular economy actors.

The urgency of this program is further heightened given that the waste problem in Cimahi is not only technical but also socio-ecological. This activity directly addresses real challenges on the ground, provides solutions based on community participation, and strengthens synergy between the government, academics, and residents in creating a clean and sustainable environment. By strengthening ecological awareness and developing creative economic skills, the community is engaged not only as beneficiaries but also as agents of change, actively participating in environmental sustainability. Thus, this community service activity is expected to not only address the waste emergency but also establish a management model that can be replicated in other areas of Cimahi City, while also making a tangible contribution to the implementation of a green economy at the local level.

2. Literature Review

2.1. State of the Art

The approach implemented in this community service activity combines field visits to areas identified as central to the waste problem and hands-on workshops designed to train residents in practical waste management and monitoring techniques. This participatory method ensures that the community is not only a beneficiary but also an active actor in managing waste sustainably. Similar initiatives have been successfully implemented in previous community service programs and research projects, including those by Sodono (2024), Andina (2019), Bees and Williams (2017), Harahap and Muhamad (2024), Gallardo et al. (2020), Baynova (2021), Kirillova and Musinova (2022), Schüch et al. (2016), and Han et al. (2010). These studies highlight that effective waste management requires not only appropriate infrastructure but also systematic community involvement and continuous supervision to ensure compliance and sustainability.

In line with these findings, the present program integrates theoretical and practical components to strengthen waste governance in RW 07, Melong Village, Cimahi City. The combination of field observation, participatory training, and community-based monitoring aligns with international best practices in waste management and community empowerment, supporting the transition toward a circular and low-carbon urban economy.

2.2. Community Service Roadmap

The research team has developed a roadmap of community service activities that reflects a progressive trajectory from prior programs to future plans. This roadmap demonstrates the continuity of engagement and capacity building within local communities, particularly in West Java Province.

Table 1: Community service roadmap of the research team

Completed Community Services	Ongoing Community Services	Planned Community Services
Training and mentoring on village cooperative management in Darmaga and Pasanggrahan Villages, Subang (2019).	Structured Waste Management Monitoring System Based on the Separate Collection Scheme as an Economic Empowerment Strategy for the Community of RW 07, Melong Village, Cimahi City (2025).	Implementation of Green Economy Approaches to Enhance Community Welfare.
Entrepreneurship Training for School-Aged Children (2022).		
Community mentoring for tourism potential and local product development in Cihanjawar Village, Purwakarta Regency (2023).		
Development of financial report preparation training using accounting applications for MSMEs in Cipageran (2024).		

2.3. The Separate Collection Scheme

According to Gallardo et al. (2020), the Separate Collection Scheme (SCS) aims to minimize the generation of new waste while maximizing recycling efficiency by ensuring that all residual waste is properly sorted, processed, and utilized. The separation of organic waste produces high-quality compost suitable for agricultural and horticultural use, while the separation of recyclable materials improves the efficiency of sorting, recycling, and incineration processes. Organic waste decomposition in landfills is one of the main contributors to methane gas emissions, a potent greenhouse gas. Thus, recycling and reusing organic waste not only conserves energy resources but also mitigates climate impacts. The SCS method can be applied in rural or semi-urban areas such as Melong Village to provide an adaptive, replicable solution to waste management challenges. The following steps outline the key components of the SCS method implemented in this project:

1. Waste Sorting Patterns: Each neighborhood manages its waste collection differently, including schedule and handling of hazardous waste. The adapted recycling system introduces color-coded waste bins:
    a. Blue bins for paper and cardboard (magazines, flyers, books, cartons).
    b. Yellow bins for cans, aluminum, and plastics (bottles, styrofoam, beverage cartons).
    c. Black bins for non-recyclable residual waste (used tissues, diapers, cigarette butts).
    d. Glass bins in a distinct color to prevent contamination of recyclable materials.
2. Recycling Procedures: After sorting, waste is processed according to the 4R principles (Replace, Reduce, Reuse, and Recycle):
    a. Replace: Substituting non-biodegradable products with environmentally friendly alternatives (e.g., reusable bags instead of plastic, minimizing styrofoam use).
    b. Reduce: Minimizing waste generation in daily activities (e.g., bulk purchasing, using refill packaging, bringing personal shopping bags).
    c. Reuse: Utilizing used materials creatively (e.g., turning bottles into plant pots or craft materials).
    d. Recycle: Processing recyclable waste into new, valuable products through community workshops and simple technologies.
3. Sustainable Implementation: The success program requires commitment and collaboration from all stakeholders, including community leaders, residents, and local government. Clear regulations, division of responsibilities, and continuous capacity-building are essential to maintain long-term program sustainability.
4. Monitoring and Evaluation: Regular monitoring ensures that the program runs effectively and allows for adjustments when obstacles arise. Evaluation activities include field inspections, questionnaires, and interviews with participants to assess performance, satisfaction, and impact.

2.4. Waste Management Supervision Framework

The project adopts Handoko's (2013) control theory, which identifies five dimensions of supervision to ensure the effectiveness of organizational operations. These dimensions are applied to waste management supervision as follows:

1. Standard Settings: Supervision begins with defining operational standards that serve as benchmarks for evaluating results. These include goals, targets, and quotas for waste collection and sorting. The village administration establishes a waste management team consisting of a coordinator, supervisors, and local volunteers, reporting to the Cimahi City Environmental Office (DLH).
2. Performance Measurement Criteria: The next step involves developing measurable indicators to assess the implementation of activities. Monitoring tools include written reports, communication records, and digital documentation that ensure transparency and traceability.
3. Activity Measurement: This stage employs direct observation, structured reporting, and automated procedures to monitor ongoing waste management operations. Continuous observation allows the identification of real-time challenges and field deviations.
4. Performance Comparison and Deviation Analysis: Actual performance is compared with established standards. Deviations are analyzed to identify gaps in implementation. The project employs the Separate Collection Scheme as a practical reference for evaluating whether waste sorting and recycling targets are being met effectively.
5. Corrective Action: When deviations or inefficiencies occur, corrective actions are coordinated with local stakeholders, including the village government and the Cimahi City Environmental Agency (DLH). Actions may include additional training, system refinement, or strengthening of community responsibilities to align with program objectives.

This integrated supervision model ensures accountability, consistency, and long-term sustainability in implementing community-based waste management in Melong Village, supporting Cimahi City's vision of an environmentally resilient and economically empowered urban ecosystem.

3. Materials and Methods

3.1. Materials

This community service project was conducted in RW 07 Melong Village, Cimahi City, West Java, which faces serious waste-management problems due to limited landfill capacity and low public awareness of waste separation.

The activity involved academic facilitators from the Faculty of Economics and Business, Cimahi City Government representatives, and local community groups. Supporting tools include survey forms, color-coded waste bins (blue – paper/cardboard, yellow – metal/plastic, black – organic waste), informational signage, and educational media for public outreach.

3.2. Methods

The program design consists of two primary components: waste sorting (segregation) and waste handling (treatment), integrated through education, mentoring, and continuous monitoring.

Table 2: Community service design

Aspect	Identified Problems	Supporting Evidence	Solutions Implemented
Waste Sorting	• Unstrategic placement of waste storage points. • No separation between organic and inorganic waste. • Inadequate storage facilities. • Lack of coordination between households.	Field survey and interviews with local residents.	1. Installation of signboards for waste type identification. 2. Implementation of the Separate Collection Scheme (SCS) using 4R principles (Replace, Reduce, Reuse, Recycle). 3. Preparation of three color-coded bins (blue, yellow, black). 4. Development of a visual map showing household waste flows.
Waste Handling	• No recycling utilization. • Decreased air quality from garbage truck emissions. • Plastic pollution from household waste. • Open burning of waste.	Observation and community feedback from RW 07.	1. Training and mentoring on recycling techniques. 2. Provision of closed waste containers. 3. Education on plastic pollution and creative reuse into handicrafts. 4. Encouragement of recycling innovation and plastic use reduction.

3.3. Implementation Stages

The program was structured into three major stages planning, implementation, and evaluation spanning January to December 2025.

Table 3: Community service implementation timeline (2025)

Phase	Activities	Month
Planning	Coordination meetings; Determination of target area; Administrative permissions.	Jan – Feb
Implementation	Field surveys; Community education and mentoring; Execution of SCS and 4R activities; Documentation for educational outputs.	Mar – Aug
Evaluation and Reporting	Monitoring and feedback; Preparation of scientific articles; Media dissemination (print and digital); Final report submission.	Sep – Dec

3.4. Analytical Approach

The evaluation combined qualitative observation, community interviews, and impact assessment on:

1. Increased public awareness and participation in waste management.
2. Reduction in waste volume sent to landfill.
3. Establishment of community-based waste processing groups.

3.5. Expected Outcome

This method aims to establish a replicable model of waste management through community empowerment. The Separate Collection Scheme not only reduces environmental impact but also fosters a circular economy by transforming waste into valuable products such as compost and recycled crafts.

4. Results and Discussion

4.1. Planning Stage

The implementation of this community service activity began with a preliminary assessment stage designed to identify the scope and depth of waste-management challenges in Melong Village, Cimahi City. The project leader, vice leader, and treasurer, accompanied by representatives of the Faculty of Economics and Business (FEB), conducted a field survey on April 30, 2025, at the Melong Village Office. The team observed that waste accumulation was widespread, particularly around roadside collection points and near marketplaces, reflecting both infrastructure and behavioral deficiencies.

Figure 3: Preliminary field survey at Melong village

Interviews with residents and local micro-entrepreneurs revealed that many households lacked an understanding of waste categorization and disposal timing. Moreover, the existing system did not provide adequate supervisory mechanisms to ensure community compliance. Residents expressed frustration with the absence of effective coordination between the neighborhood waste handlers and the Cimahi Environmental Agency (DLH), resulting in frequent pile-ups. The survey results guided the team in formulating an intervention strategy grounded in the Separate Collection Scheme (SCS) and the 4R principles (Replace, Reduce, Reuse, and Recycle). This combination was considered both contextually feasible and pedagogically effective for the target community. The team also conducted coordination meetings with village leaders to discuss permit issuance, participant recruitment, and logistical support. The planning stage successfully established institutional collaboration between the university, local government, and residents ensuring that the community service would not be perceived as a one-off campaign but as a structured, participatory, and replicable environmental program.

4.2. Activity Preparation

After the community service program was officially approved by the UNJANI Research and Development Institute (LPPM) on June 26, 2025, the organizing team began holding a series of coordination meetings. The first meeting was held on July 10, 2025, in the meeting room of the Faculty of Economics and Business (FEB), to discuss the implementation plan, role allocation, and logistical support. A follow-up virtual coordination meeting was held on July 19, 2025, via Zoom Meeting to finalize technical details and ensure the tasks and responsibilities of each team member.

Figure 4: regular online coordination discussion

The preparation phase focused on confirming the target area and selecting participants, finalizing educational materials, and coordinating with the Melong Village government to ensure community participation. The activity was then scheduled for July 22, 2025, at the Melong Village Office, a strategic location capable of accommodating more than 50 participants. The location's accessibility and open space allowed for interactive demonstrations and banner display.

4.3. Implementation and Field Results

Based on the preliminary survey and interviews with community leaders such as Mr. Budi, Head of RW 07, several structural and behavioral issues were identified in the waste-management system:

1. Limited public understanding of waste segregation (organic vs. inorganic).
2. Minimal household participation in supervision or reporting of violations.
3. Dependence on sanitation workers, with low collective accountability.
4. Inadequate facilities such as TPS (Temporary Waste Sites) and sorting bins.

These findings confirmed the urgency of a community-based supervision model integrated with Separate Collection Schemes (SCS) and the 4R principles. The program's implementation aims to address these barriers through education, participatory practice, and motivation-building.

Figure 5: community enthusiasm during the event

The community service workshop, entitled "Supervising Structured Waste Management through Separate Collection Schemes as a Strategy for Community Economic Empowerment in Melong Village", was conducted with high enthusiasm and strong collaboration between academia, government, and residents. The activity began at 08:00 a.m., with registration and pre-test, followed by an opening ceremony featuring speeches from the Vice Dean of FEB UNJANI, the Project Leader, and the Head of Melong Village.

Each speech emphasized the shared vision of sustainable waste governance and the dual goal of environmental care and local economic empowerment. The ceremony concluded with the presentation of plaques to local representatives, symbolizing institutional cooperation between UNJANI and the Cimahi City Government.

Figure 6: Opening remarks from the melong village office

4.4. Community Education and Participation Session

The main session began at 9:10 a.m., led by a keynote speaker from the Faculty of Economics and Business (FEB) at UNJANI. It focused on monitoring structured waste management through the Separate Collection Scheme (SPT). Participants were guided on how to categorize organic, inorganic, and residual waste, and were introduced to the economic value of waste through recycling and upcycling.

An interactive discussion ensued, allowing residents to share their challenges and ideas. Several participants shared that they often faced social hesitation to address improper waste disposal due to fear of conflict. This observation highlighted socio-cultural barriers where environmental management is perceived as the sole responsibility of city

officials. To address this, the workshop emphasized community-based monitoring, supported by neighborhood/community unit (RT/RW) coordination, a simple signage system, and waste bank integration.

Figure 7: Presentation of main educational materials

The session continued until 12:15 p.m., followed by a final test, prize distribution, and closing remarks. The evaluation results showed a significant increase in participants' knowledge and awareness compared to the initial test results. Participants demonstrated an increased understanding of:

1. Waste classification and sorting procedures.
2. The role of monitoring and reporting in maintaining cleanliness.
3. The economic potential of recycled materials.
4. The importance of collective action in environmental governance.

Figure 8: Interactive Q&A Session with Participants

4.5. Discussion

The findings from this activity reinforce the methodological foundation that community participation and environmental education are key to sustainable waste management. Prior to the intervention, the majority of residents demonstrated low environmental literacy, limited access to infrastructure, and weak coordination among stakeholders. Through structured educational sessions and interactive practices, participants transitioned from passive waste generators to active agents of environmental stewardship. Improved pre- and post-test scores demonstrate that environmental education and direct engagement can effectively change knowledge and behavior. This aligns with Gallardo et al. (2021), who emphasized that the Separate Collection Scheme is most effective when combined with local capacity building and consistent public awareness. Socially, this program helped break down hierarchical perceptions of responsibility. Residents learned that effective waste management is not solely the government's responsibility but also a shared responsibility as citizens. The integration of academic support, community collaboration, and local governance resulted in a self-sustaining waste stewardship model that can be replicated in other urban areas in Cimahi. Economically, several participants expressed interest in establishing waste banks, composting initiatives, and partnerships with local recyclers. This reflects a transition from an end-of-pipe waste mentality to a circular economy mindset, which aligns with Harahap and Muhamad (2024) and Sodono (2024). By framing waste as a resource, not a problem, this program creates new opportunities for micro-entrepreneurship and community-based innovation.

The social cohesion observed during the program also demonstrates that a collaborative learning environment where residents, students, and local leaders work together can accelerate behavioral change. Therefore, the success of this

initiative lies not only in its technical outcomes but also in its ability to foster collective awareness, environmental stewardship, and socio-economic empowerment. In short, the implementation of a separate collection scheme-based supervision system in Melong Village demonstrates that a structured, participatory approach can lead to significant improvements in both environmental behavior and community empowerment. The program's results reaffirm that sustainable urban cleanliness requires not only infrastructure but also ongoing community education, coordination, and engagement.

5. Conclusion

The community service program, "Structured Waste Management Supervision through a Separate Collection Scheme as an Economic Empowerment Strategy for the Community of RW 07, Melong Village, Cimahi City," successfully achieved its objectives through participatory education, practical training, and collaborative engagement between academics, government officials, and local residents. The implementation of the Separate Collection Scheme (SCS), combined with the 4R principles (Replace, Reduce, Reuse, Recycle), has proven effective in raising public awareness, strengthening local participation, and encouraging environmentally friendly behaviors. Pre- and post-trial evaluations demonstrated significant improvements in residents' understanding of waste classification, monitoring practices, and sustainable waste management. Beyond technical outcomes, the program fostered a shift in social attitudes from dependence on municipal waste services to shared community responsibility. The initiative also generated positive socio-economic impacts by encouraging residents to explore waste-based entrepreneurship, such as recycling crafts, compost production, and waste bank management. The results confirm that environmental education and a structured monitoring model can be catalysts for community empowerment and sustainable urban governance. Collaboration between universities, local governments, and communities builds a replicable model for integrating academic knowledge into real-world social transformation. In short, this program not only addresses local waste management issues but also lays the foundation for a long-term circular economy approach at the village level that contributes to a cleaner environment, improved well-being, and heightened community awareness.

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