

EMPOWERING WOMEN IN ORGANIC WASTE MANAGEMENT THROUGH MAGGOT CULTIVATION IN URBAN YOGYAKARTA

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ABSTRACT

Waste management has become an increasingly complex problem in Yogyakarta City, particularly after the temporary closure of the Piyungan Integrated Waste Disposal Site (TPST). Kampung Jogoyudan in Gowongan Village, Jetis District, is one of the densely populated urban areas significantly affected by limited waste disposal capacity. This community service program aims to empower women in managing organic waste through maggot (Black Soldier Fly larvae) cultivation as an innovative bioconversion technology. The method involves awareness campaigns, technical training, and partnership development with local stakeholders. The initial implementation stage shows a growing understanding among participants regarding waste separation and organic waste treatment using maggot technology. Moreover, maggot cultivation is identified as a potential source of additional income through the sale of larvae and organic fertilizer. The activity strengthens women's roles at least 30 percent as agents of environmental change while supporting Yogyakarta's vision as a sustainable and livable city.

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INTRODUCTION

The waste management problem in the Special Region of Yogyakarta (DIY) has evolved into an increasingly complex economic and environmental issue, especially since the temporary closure of the Integrated Waste Management Facility (TPST) Piyungan. For nearly two decades, the region's waste management system has heavily relied on the existence of this facility. When the facility ceased operation, waste collection and processing at both urban and community levels were severely disrupted. This situation revealed the fragility of the region's centralized waste management system, which has yet to optimally implement the principles of a circular economy.

According to Bappeda DIY (2022), daily waste generation in the region reached 1,231.55 tons, while the management capacity was only about 757.72 tons per day. This leaves a gap of 473.83 tons or approximately 39 percent of waste that is not effectively handled each day. The imbalance between production and management capacity reflects a market failure in environmental resource management, where existing social and economic mechanisms have not provided sufficient incentives to reduce, sort, and utilize waste.

The waste management crisis is most acutely felt in densely populated areas such as Kampung Jogoyudan, Gowongan Village, Jetis District, Yogyakarta City. This area faces limited space, high population density, and a decline in the effectiveness of collective waste collection systems following the closure of TPST Piyungan. The accumulation of waste in communal areas has led to negative impacts, including unpleasant odors, health problems, and environmental degradation. This condition contradicts the vision of Yogyakarta City as a “BERHATI NYAMAN” city (Clean, Healthy, Green, and Comfortable), which emphasizes a balance between economic, social, and environmental development.

Women play a crucial role in the socio-economic system, making them key actors in household environmental management. Based on data from BPS DIY (2023), of the total productive-age population (≥ 15 years) of 3,021,647 people, 1,540,503—or about 51 percent—are women, with 384,706 of them being housewives. This position makes women the main drivers in shaping consumption behavior and managing household waste. Therefore, women's empowerment can serve as a strategic entry point for developing community-based waste management systems.

An innovation aligned with the green economy approach can be realized through maggot cultivation or the use of Black Soldier Fly (BSF) larvae as a method of organic waste processing. Maggots are capable of efficiently degrading organic waste while producing natural animal feed and organic fertilizer with high economic value. This simple technology

holds great potential to reduce the volume of organic waste ending up in landfills while creating new business opportunities for local communities, especially for women. This system not only supports environmental sustainability but also increases household income and strengthens the local economy.

This community service program aims to empower women in Kampung Jogoyudan in managing organic waste through maggot cultivation, as an integrative strategy that combines environmental and economic aspects into a single community empowerment model. The objectives of this program include reducing household-scale organic waste volume, enhancing women's capacity in environmentally based productive economic activities, and developing a sustainable waste management model that upholds circular economy principles in densely populated urban areas. This initiative serves not only as a solution to the technical problems of waste management but also as an effort to strengthen the foundations of a circular economy and inter-community self-reliance in achieving sustainable development in Yogyakarta City.

LITERATURE REVIEW

1. Urban Waste Management

Waste management in urban areas is an environmental issue directly related to population growth and economic dynamics. The increase in population, urbanization, and high household consumption accelerates the rate of waste generation (Yuan et al., 2021). This condition places significant pressure on management systems, especially in developing countries that still face limitations in infrastructure, technology, and institutional capacity.

The problem of waste management is not merely technical but also socio-economic, due to the low level of community participation in sorting and processing waste at its source. The accumulation of waste in final disposal sites generates external costs, including environmental pollution, deterioration of air quality, and high public budget burdens. Modern management strategies emphasize the concepts of waste reduction and reuse through active community involvement as the main actors in creating an efficient and sustainable system.

2. Maggot Bioconversion Technology

The bioconversion approach using Black Soldier Fly larvae (*Hermetia illucens*) has emerged as an effective innovation for tackling organic waste problems. This species of larvae can decompose organic waste quickly and efficiently. Oemar et al. (2023) found that approximately 10,000 larvae can decompose 5 kg of organic waste in just one day. The

process not only reduces waste volume by 70–80%, but also produces two economically valuable products: maggot larvae as protein-rich animal feed, and residue (frass) that functions as organic fertilizer (Nurdi & Diswandi, 2024).

The application of maggot bioconversion reinforces the principles of a circular economy, where organic waste is processed back into new inputs for the production system. This technology has great potential to be applied in densely populated urban areas such as Yogyakarta, as it requires relatively little land, is energy efficient, and offers economic opportunities for local communities.

3. The Role of Women in Environmental Management

Women play a crucial role in maintaining environmental sustainability, particularly within households and communities. Their role extends beyond domestic activities to decision-making in the management of daily resources. Research by Pakasi (2024) shows that women's involvement in environmental activities correlates with increased social awareness and consistency in environmentally friendly behavior. Utami (2020) notes that women's characteristics—such as perseverance, care, and strong responsibility for cleanliness make them key drivers in community-based environmental programs. Empowering women through training and assistance in organic waste management provides access to new knowledge and economic resources, thereby strengthening family welfare while improving the quality of the urban environment.

4. Community Empowerment Model

Community empowerment is viewed as an effort to enhance the abilities of individuals and groups so they can manage resources and make independent decisions—Kruahong et al., 2023 stated community empowerment is defined as a process through which individuals and communities enhance their capacity, access resources, strengthen participation, and gain greater control over decisions affecting their lives. In the context of waste management, empowerment models are implemented through technical training, continuous mentoring, and the establishment of cross-sector partnership networks (Oktamalandi et al., 2023).

Empowerment programs focusing on maggot cultivation generate economic added value while strengthening social participation, particularly among women's groups in urban areas. These activities not only promote economic self-reliance but also foster productive behavior that supports the achievement of sustainable development goals such as gender equality, sustainable cities, and responsible consumption and production.

MATERIAL AND METHOD

1. Location and Target Group

The community service activity was carried out in Kampung Jogoyudan, Gowongan Village, Jetis District, Yogyakarta City. This area is densely populated with limited open land availability, making organic waste management one of the main environmental challenges in urban settings. The location was selected purposively based on population density and the potential for community participation in environmentally based activities. The main target group of the program consisted of 25 women, including housewives and community leaders at the neighborhood (RT/RW) level. This group was chosen because of their strategic roles in domestic and social-environmental activities, as well as their potential to act as agents of change in implementing sustainable waste management practices in their community.

2. Implementation Method

The approach used was participatory, placing the community as the main actors in all stages of the activity. The implementation process was designed through three main stages:

Socialization and Education

The initial phase focused on improving participants' knowledge through educational sessions about sorting organic and inorganic waste, the benefits of maggot-based bioconversion, and its economic potential. Education was delivered interactively through discussions, visual demonstrations, and Q&A sessions to help participants understand the basic principles of household waste management using maggots.

Technical Training

This phase emphasized the development of participants' practical skills. Training materials included the preparation of maggot breeding media, techniques for hatching Black Soldier Fly eggs, and larval maintenance using household organic waste. All sessions were conducted through hands-on training to enable participants to independently apply maggot cultivation techniques.

Partnership Networking

After the technical training, participants were facilitated to establish partnerships with external parties such as fish farmers and local agricultural producers. These collaborations aimed to create a new economic cycle through the use of maggot products as animal feed and their residue (frass) as organic fertilizer. This stage also served to expand the socio-economic

networks of women's communities in Kampung Jogoyudan.

3. Supporting Data

Supporting data were collected through field observations, activity documentation, and short surveys conducted among participants. Descriptive analysis was used to assess changes in participants' knowledge and skills before and after the program. The results were utilized to evaluate the program's effectiveness in enhancing women's capacity for maggot-based organic waste management. Table 1 shows that approximately 39% of waste in the Special Region of Yogyakarta remains unmanaged, indicating that household- and community-based waste management approaches are vital alternatives to reducing the burden on the city's waste management system.

Table 1. Waste Generation and Management Volume in the Special Region of Yogyakarta (DIY), 2022

Category	Value	Unit
Waste Generation Volume	1,231.55	Tons/day
Managed Waste Volume	757.72	Tons/day
Gap (Generation Managed)	– 473.83	Tons/day (~39%)

Source: Bappeda DIY, 2022.

RESULT AND DISCUSSION

After the socialization session, participants' understanding of waste management increased significantly. Before the activity, only 24% of participants were familiar with the concept of maggot bioconversion; after the training, this figure rose to 88%.



Figure 1. Participants of the Organic Waste Management Training

The organic waste management program using maggots in Kampung Jogoyudan was

implemented through a series of structured and participatory activities. Each stage was designed to build community awareness, enhance technical capacity, and create sustainable economic linkages. The process began with coordination and socialization, continued with hands-on training and the establishment of pilot maggot cultivation units, and concluded with mentoring, partnership development, and evaluation. The following table outlines the sequence of activities conducted during the program.

Table 2. Series of Activities on Organic Waste Management Using Maggot in Kampung Jogoyudan, Gowongan, Jetis, Yogyakarta

No	Stage of Activity	Description	Output/Outcome
1	Preparation and Coordination	Coordination with local leaders (RT/RW) and women's groups to determine participants, schedule, and location of activities.	Established coordination network and list of 25 participants.
2	Socialization and Education	Delivery of educational material about waste sorting, introduction to maggot bioconversion, and the economic and environmental benefits.	Increased awareness and understanding of maggot-based organic waste management.
3	Demonstration and Technical Training	Practical training on maggot cultivation techniques, including preparation of rearing media, hatching BSF eggs, and larval feeding using household organic waste.	Participants acquire practical skills for independent maggot cultivation.
4	Installation of Pilot Maggot Units	Construction of simple maggot cultivation containers in selected households as demonstration units.	Formation of 5 pilot maggot units managed by local women's groups.
5	Monitoring and Mentoring	Regular visits and mentoring to ensure proper maintenance, feeding, and harvesting of maggots.	Improved consistency and productivity in maggot cultivation practices.
6	Partnership Development	Linking participants with fish farmers and local agricultural groups for utilization of maggot (as feed) and frass (as fertilizer).	Creation of small-scale circular economy network at community level.

7	Evaluation and Reflection	Assessment of knowledge improvement, waste reduction, and participant feedback for program improvement.	88% of participants demonstrate better understanding and practical ability in organic waste management.
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Source: Primary data

Following the implementation of the training and partnership activities, the program generated measurable impacts across several dimensions—knowledge, behavior, skills, economic empowerment, and environmental improvement. The active participation of women not only enhanced their capacity in maggot-based organic waste management but also fostered social cohesion and collective responsibility toward sustainable urban living. The results of these achievements are summarized in the following Table 3.

Table 3. Outcomes of the Maggot-Based Organic Waste Management Program in Kampung Jogoyudan

Aspect	Achievement / Result
Knowledge	Improved understanding of the function of maggots and the life cycle of the Black Soldier Fly (BSF) in organic waste management.
Attitude and Awareness	Increased awareness of waste sorting and reducing household organic waste.
Skills	Participants are able to prepare cultivation media, hatch eggs, and harvest maggots independently.
Social Institution	Formation of the “Urban Yogyakarta Maggotpreneur Women Group.”
Economic	Additional income of IDR 150,000–300,000 per month from selling maggots and frass (kasgot).
Environmental	Reduction of organic waste volume by up to 70% per week.
Social	Establishment of the “Jogoyudan Green Women Group” as a driving force for independent waste management.

Source: Evaluation of Programme

Socialization and training activities have proven effective in increasing participants' knowledge about the importance of organic waste management and the potential of maggots as an environmentally friendly bioconversion solution. Before the activity, the majority of participants did not understand that BSF larvae function as natural decomposers that quickly

break down organic waste. After the training, participants demonstrated an increased conceptual understanding of the BSF life cycle, how to breed maggots, and how to use them to reduce household waste. This increase in ecological literacy is an important basis for changing the behavior of urban communities in managing waste independently.

An increase in environmental awareness was clear after the activities took place. Participants began to get used to sorting organic and inorganic waste and understood the economic value of organic waste management. This behavioral transformation not only affected the main participants but also spread to other family members. A new habit emerged in the form of collecting food scraps for maggot feed, which showed a paradigm shift from “throwing away waste” to “managing valuable waste.”

Technical training and field assistance equip participants with practical skills in household-scale maggot cultivation. Participants can prepare simple cultivation media from a mixture of bran, vegetable scraps, and rotten fruit, using used plastic buckets with ventilation holes. They also successfully hatch eggs, raise larvae, and harvest maggots independently. The by-product, maggot castings, is used as liquid and solid organic fertilizer for garden plants. These skills form the basis for a circular economy at the household level.

This activity gave rise to a community group called “Ibu-Ibu Maggotpreneur Urban Yogyakarta” (Yogyakarta Urban Maggotpreneur Mothers), which has 15-20 members. This group serves as a forum for collective learning, sharing best practices, and establishing cooperation with external parties. The existence of this social institution strengthens social cohesion and environmental solidarity, as well as opening up opportunities for collaboration with government programs related to the green economy and women's empowerment.

From an economic perspective, this activity has had a concrete impact. Participants are able to produce 5-10 kilograms of wet maggots per cycle, which are sold for Rp15,000-Rp20,000 per kilogram. The by-product, kasgot fertilizer, is also sold at Rp3,000-Rp5,000 per kilogram. The average additional income reaches Rp150,000-Rp300,000 per month, which is quite significant for households without requiring large capital. These findings demonstrate the potential of maggots as a green economy-based microbusiness that supports the economic resilience of urban families.

Tabel 4. Production and Revenue per Month

Product	Production yield/ Cycle	Price (IDR/kg)	Average Income/Month (IDR)
Wet Maggot	5–10 kg	15.000–	150.000–200.000

		20.000	
Kasgot (Organic)	2–5 kg	3.000–5.000	10.000–25.000
Total Estimate Revenue			160.000–300.000

Source: Primary data

Ecologically, this activity reduces the volume of household organic waste by around 50–70% per week. Most food waste is no longer disposed of in landfills but is processed into maggot feed. The environment becomes cleaner, odors are reduced, and waste management costs at the neighborhood level are lowered. The application of the bioconversion principle demonstrates synergy between ecological and economic approaches, which directly supports sustainable development goals (SDGs), particularly in responsible consumption and production (Goal 12).

This activity also fosters confidence, social solidarity, and entrepreneurial spirit among participants. A new group called the “Jogoyudan Green Women Group” has emerged, committed to managing waste independently and developing maggot-based derivative products. Increased participation of women in green economic activities shows how environmental management can be an instrument of social and economic empowerment.

The obstacles that arise are mainly related to fluctuations in the supply of organic waste and the influence of weather on the maggot life cycle. To maintain sustainability, technical assistance from universities and support from local governments through the provision of organic waste collection facilities are needed. The integration of maggot activities into the waste bank and environmental cooperative systems is a strategic direction for the sustainability of the program.

CONCLUSION AND RECOMMENDATION

1. Conclusion

The community service program implemented in Jogoyudan Village, Yogyakarta, proves that maggot farming based on women's participation is an effective and sustainable strategy for managing organic waste in densely populated urban areas. The increase in knowledge, technical skills, and environmental awareness of the participants contributed directly to reducing the volume of household waste and creating a cleaner environment.

This activity not only produces ecological benefits, but also has a real social and economic impact through the formation of the “Ibu-Ibu Maggotpreneur Urban Yogyakarta” and “Jogoyudan Green Women Group” groups. These groups have become the embryo of

social institutions capable of driving community-scale circular economies based on the principles of green micro enterprises. **The active role of women** has proven to be a catalyst for change in promoting environmentally friendly behavior and strengthening household economic resilience through value-added waste management. Due to the high population density of their neighborhoods, proper waste management has become an immediate necessity. Several respondents reported that participation in waste bank activities not only generated additional income but also strengthened social interaction among residents through regular meetings, collective waste sorting activities, and environmental campaigns.

Recomendation

Maggot bioconversion technology needs to be integrated into sub-district or city-level waste management policies as part of a community-based waste-to-resource strategy. Local governments can use the Kampung Jogoyudan model as a pilot project for efficient and inclusive urban organic waste management. Continued assistance is needed for women's groups to deepen their knowledge of business management, product packaging, and marketing of maggot products so that activities do not stop at the technical stage but develop into sustainable productive economic units.

Collaboration between women's groups, fish farmers, urban farmers, MSME actors, and the private sector needs to be expanded to create a green value chain. These partnerships have the potential to strengthen the market for maggot and kasgot fertilizer products, while fostering a circular economy ecosystem in urban areas. Local governments and universities are expected to provide institutional support in the form of technical training, applied research, and environmental business incubation schemes.

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