

Engaging Stakeholders through Proper Waste Management System to Achieve a Sustainable Campus: A Case Study at UMY, Indonesia

Yeni Rosilawati¹, Fitria Rahmawati², and Tommi Hidayat³

¹ Communication Department, 55183 Universitas Muhammadiyah Yogyakarta, Indonesia

² English Language Education Department, 55183 Universitas Muhammadiyah Yogyakarta, Indonesia

³ Extension and Development Communication, 55223 Universitas Gadjah Mada, Indonesia

Abstract. A large waste management system becomes inevitable for a campus due to its population and various activities. Therefore, developing and implementing a waste minimization plan to encourage sustainable campus practices is challenging. Universitas Muhammadiyah Yogyakarta (UMY), with its nickname as a green campus, certainly has more attention to a sustainable ecological balance, as proved by UMY's inclusion in the UI Green Metric World University Ranking, focusing on energy use, water use, waste treatment, transportation, and infrastructure. In 2020, UMY won 137th place after competing with 912 universities in 85 countries. This paper would like to analyze the stakeholder's engagement in waste management systems to achieve a sustainable campus, choosing UMY as a single case study. This study utilized a qualitative research method with a case study design. Data were gathered through an in-depth-interview and documentation. The findings of this study identify strategies implemented by the stakeholders in managing waste in the university environments, including waste separation, waste collection and disposal, waste transportation, and waste processing and recycling. In addition, the findings reinforce the role of the stakeholders as the key, primary, and secondary stakeholders in waste management towards achieving a sustainable green campus. **Keywords:** Waste Management System, Sustainable Development Goals, Sustainable Campus, Green Campus, Stakeholder's Engagement

1 Introduction

Waste management continues to pose a challenge in various countries worldwide. According to data from the World Bank, approximately 1.3 billion tons of waste are generated globally each year, equivalent to around 1.2 kg of waste per person per day [1]). In Indonesia, a country with a population of 275.77 million, waste management is also a significant concern. According to the Ministry of Environment and Forestry, in 2022, Indonesia produced 21.7 million tons of waste, with the largest composition coming from food waste at 41.4%, followed by plastic at 18.5%, wood, branches, and leaves at 13.3%, and paper and cardboard at 10.8%.

The issue of waste is a significant problem faced by Indonesian society, ranging from

major cities to rural areas. Ineffective waste management leads to negative environmental impacts, human health issues, and social problems [2]. Insufficient waste management infrastructure and lack of public awareness regarding the importance of proper waste management further exacerbate this situation [3].

A surge in waste production is caused by high population growth, rapid industrialization, massive urbanization, and significant economic development [4]. Yogyakarta Province, an educational region with numerous universities, is not exempt from waste issues. According to data from the Environmental and Forestry Agency of the Special Region of Yogyakarta [5], Yogyakarta produces 2,117.22 tons of waste daily.

Waste is a problem in urban environments and communities and a concerning issue within university settings. As centers of education and research, universities often generate significant waste daily. Various activities undertaken by faculty, students, staff, and other parties contribute to waste production through food consumption, paper usage, plastic consumption, and other materials [6]. The impacts of this issue reflect on health, cleanliness levels, campus sustainability, and air and soil pollution, which can potentially harm human health and the surrounding environment [7].

Universitas Muhammadiyah Yogyakarta (UMY) is one of the largest private universities concerned about waste issues. UMY is known as a green campus, emphasizing maintaining sustainable ecological balance. UMY is included in the UI Green Metric World University Ranking, focusing on energy, water, waste management, transportation, and infrastructure. In 2020, UMY ranked 137 after competing with 912 universities in 85 countries.

UMY has been initiating efforts to realize a green campus through programs such as green open space planning, intelligent building construction, wise paper usage, and energy-efficient equipment since 2011. As a result of these programs, UMY has been ranked as the 11th greenest university in Indonesia in 2019 based on UI Green Metric [8].

UMY has taken effective steps in realizing a green and sustainable campus by implementing a waste management system. This system is the main focus of the campus to reduce waste through organized separation, storage, collection, transportation, and waste processing [8]. UMY also involves various stakeholders on campus to ensure that this system is not merely a policy stated in writing but a tangible practice carried out by all university stakeholders.

Increasing awareness and active participation of all university members in waste management is crucial. Bahçelioğlu et al. (2020) and Budihardjo et al. (2021) stated that universities must employ additional strategies to address the significant complexity of waste generation within their environments [9] [6]. Stakeholder involvement and waste management systems are two inseparable aspects of reducing waste generation in university settings [10]. As waste management stakeholders, faculty members, students, educators, and staff significantly impact waste reduction practices and establish a sustainable future [11].

University stakeholders are an important factor in significant waste accumulation. Bahçelioğlu et al. (2020) and Budihardjo et al. (2021) revealed that waste management systems in universities are the responsibility of all elements within the university environment [9] [6]. A comprehensive study on the involvement and awareness of stakeholders in waste management becomes a crucial point among academicians.

The university is ideal for cultivating human awareness towards wise waste and environmental management. Gunawardana (2018) suggested that achieving sustainable waste management will be challenging without sufficient awareness [12]. Vicente-Molina et al. (2013) argued that education strongly influenced environmental consciousness and could foster a positive attitude towards waste reduction [13]. Environmental knowledge and awareness are crucial factors in the responsibility towards the environment to

implement an effective, sustainable waste management system in higher education institutions [14].

This research analyzes university stakeholders' involvement in managing waste in the university environment to achieve a sustainable campus. The findings of this study provide strategies and strengthen the role of stakeholders in waste management toward achieving a sustainable green campus.

2 Methodology

This research was conducted at Universitas Muhammadiyah Yogyakarta in the Special Region of Yogyakarta, Indonesia. The method used in this study was a Qualitative research with a case study design. Qualitative research is an analytical method that seeks to understand the meanings behind individuals or groups in social or human issues [15]. The case study approach was employed to focus on a specific object chosen as a case for in-depth examination, thus revealing the reality behind the phenomenon [16]. Data collection techniques involved an in-depth interview and documentation.

Table 1. A Categorization of Stakeholders in the Waste Management System at Universitas Muhammadiyah Yogyakarta

Category	Stakeholders
Key Stakeholder	University as the policy maker
Primary Stakeholders	Professors, students, teaching staff, employees
Secondary Stakeholders	Cafeteria personnel, campus laboratory practitioners, janitorial staff

Table 1 classifies stakeholders within the waste management system at UMY. These stakeholders are divided into key, primary, and secondary. Each category assumes distinct roles and responsibilities, serving different objectives.

3 Findings and Discussion

Universitas Muhammadiyah Yogyakarta (UMY) is an institution of higher education established in 1981 and located in Bantul Regency, Special Region of Yogyakarta. The UMY campus covers an area of approximately 33 hectares, with 69% of the total area dedicated to academic and teaching activities, while the remaining 31% is designated as green space. With such a sizable campus, UMY has implemented a robust strategy to enhance environmental quality and sustainability.

The waste management system at UMY is a holistic approach that involves all academic members as university stakeholders in managing waste within the campus. UMY has implemented a waste management program to foster a positive attitude among academic members toward environmental issues and waste management. This decision is based on understanding a significant relationship between the university's attitude towards waste management practices [17] [18].

UMY acknowledges that a positive attitude towards environmental issues can promote and influence responsible waste management practices. Through this mindset, the university encourages each faculty, including professors, staff, and students, as primary and secondary stakeholders, to actively contribute and play a role in wise waste management.

3.1 Analysis of Stakeholder Engagement in Waste Management Systems

An effective and sustainable waste management system requires stakeholders to be involved in waste management [19]. This analysis aims to identify the roles and contributions of each university stakeholder in decision-making regarding waste management and the implementation of predetermined waste management policies.

3.1.1 Key stakeholder

As a key stakeholder, Universitas Muhammadiyah Yogyakarta has implemented a waste management system through a decree issued by the Rector of the University of Muhammadiyah Yogyakarta, numbered 053.a/SK-UMY/V/2011. This decree directs all academic community members to achieve Universitas Muhammadiyah Yogyakarta as a green campus and to enhance the quality and sustainability of the university's environment.

The waste management system policy of UMY is committed to managing both organic and non-organic waste, promoting recycling, conserving energy, and utilizing environmentally friendly materials. The primary objective of this policy is to create a clean, healthy, and sustainable campus environment. This policy represents an effort to minimize waste by implementing a wise and effective waste management system program for all stakeholders within the university environment.

3.1.2 Primary stakeholders

The Stakeholder Primer at Universitas Muhammadiyah Yogyakarta serves as the implementer of waste management on campus. As the subject of the waste management system, it bears the responsibility for the wise use of paper and plastic, ensuring that waste is disposed of in appropriate bins according to its category. This stakeholder group plays a pivotal role as an agent of change in maintaining the cleanliness and sustainability of the UMY campus environment. This group includes faculty members, staff, lecturers, and students who collaborate and remind each other about the importance of awareness and knowledge in waste management on campus.

3.1.3 Secondary stakeholders

The role of secondary stakeholders in waste management policy is as parties with influence and interest in waste management. In this regard, secondary stakeholders are directly involved in its implementation according to the policies established by the University. Secondary stakeholders include cafeteria staff, laboratory practitioners, and cleaning personnel responsible for managing waste generated from the university activities and laboratories.

3.2 Implementation of Policies and Practices in Waste Management: Waste Separation

Waste separation segregates various types of waste based on their categories, such as organic, paper, and plastic waste [20]. Waste separation facilitates effective waste

management and processing, including recycling and waste reduction. The waste separation process at Universitas Muhammadiyah Yogyakarta has been carried out seriously and integrated, as proved by the distributed waste bins placed according to their respective categories in each area (Fig. 1).



Fig. 1. Variation in Waste Disposal Locations Based on Categories

The distribution of waste bins by the university aims to enhance the awareness of university stakeholders regarding the importance of proper waste segregation according to its categories. By placing waste bins based on their respective categories, UMY hopes to educate stakeholders about the significance of correct waste separation and foster an understanding of responsible waste management practices.

3.3 Waste collection and disposal

The waste collection site serves as a gathering place for waste before it is transported to recycling, processing, or integrated waste management facilities [21]. The waste collection personnel at Universitas Muhammadiyah Yogyakarta use waste segregation to properly separate organic and inorganic waste according to their respective categories (Fig. 2).



Fig. 2. Waste Storage and Collection Facilities

3.4 Waste transportation

The transportation process involves the transfer of waste from its source or temporary storage site (TPS) to an integrated waste processing facility or final processing site (TPA) using specialized vehicles for waste transportation [22]. In this activity, these vehicles are designed with features and capacities suitable for accommodating the quantity and type of waste transported. The waste can be safely and efficiently transferred to its final destination for further processing.



Fig. 3. Waste Transportation at Muhammadiyah University Yogyakarta

The waste transportation reducea the volume of waste in temporary storage areas (TPS). TPS can continue to function properly without exceeding its capacity by regularly removing waste to maintain cleanliness and environmental health in the vicinity of TPS and to prevent unpleasant odors and disruptions to academic activities in the UMY environment.

3.5 Waste processing and recycling

The waste processing process at Universitas Muhammadiyah Yogyakarta considers well-planned and systematic separation, storage, collection, and processing steps. Waste management is conducted based on the type of waste, namely organic and inorganic, which are then transformed into products with benefits and added value.

Organic waste, consisting of food leftovers, leaves, and other organic materials, is processed through composting or composting processes. Microorganisms naturally break down organic waste until it transforms into compost fertilizer. This compost fertilizer is subsequently utilized for plants in the university environment and to improve soil fertility (Fig. 4).



Fig. 4. Process of Converting Organic Waste into Compost

The processing of inorganic waste is transformed into other products that possess added value. Inorganic waste, such as paper, plastic, and others, is processed into recycled products. The recycling process is conducted to creatively and innovatively utilize the potential of recycling inorganic waste. Recycled products from inorganic waste are transformed into indoor plant pots and handicrafts (Fig. 5).



Fig. 5. Conversion of Inorganic Recyclable Materials into Bags and Containers for Plants

3.6 Sustainability of waste management systems

The sustainability of the waste management system at UMY is carried out through a campaign to reduce the use of paper and plastic within the university's environment. This campaign represents a strategic effort to change behaviors and raise awareness among stakeholders regarding the negative impact of excessive paper and plastic consumption. The campaign's initiation includes supporting a paperless system to reduce daily paper usage in the workplace, implementing a paperless ticketing system, providing solutions through recycled paper, utilizing fingerprint and online attendance systems, and reinforcing the tagline "no plastic, no panic" [8].

Paperless technology is implemented to reduce paper consumption in various activities involving stakeholders within the campus environment. An innovation developed by UMY is an e-learning system utilized by faculty, staff, and students to engage in various activities such as online quizzes, assignment submissions, and online exams (Fig. 6). Over the past three years, UMY has extensively implemented an online examination system that

replaces the conventional paper-based examination method. This system offers a more efficient and sustainable alternative to paper management and contributes to reducing the environmental impact caused by excessive paper usage [8].



Fig. 6. E-learning and Information Management Systems

In addition to implementing an online examination system, UMY has embraced paperless concepts through several other initiatives. One of these is using student identification cards (KTM) equipped with Radio Frequency Identification (RFID) technology, allowing paperless identification. Another initiative adopting a paperless ticketing system is disseminating information without paper and implementing attendance systems using fingerprints and online presence (Fig. 7).



Fig. 7. RFID Card, Ticketing System, and Paperless Attendance

The “No Plastic, No Panic” campaign was conducted within the premises of Muhammadiyah University Yogyakarta to encourage faculty members, staff, students, and visitors to reduce the use of plastic bags when shopping. This initiative is a preventive measure in response to the rising amount of plastic waste generated. The campaign’s objective is to maintain the cleanliness of the campus and uphold the university’s aspiration to be an environmentally sustainable green campus (Fig. 8).

Overall, the involvement and cooperation of all stakeholders in waste management initiatives are running smoothly.



Fig. 8. The “No Plastic, No Panic” Campaign Program

Table 2. Synergy of Stakeholders in Waste Management System

No.	Actors	Roles	Synergy Implementation
1	Key Stakeholder	Policy Making and Promotion of Waste Management System among Stakeholders: The key stakeholders successfully develop policies related to waste management systems and effectively disseminate them to all stakeholders until an evaluation is conducted.	Well-run
2	Primary Stakeholders	Implementation of University Policies in Waste Management System: The primary stakeholders demonstrate efficient implementation of university policies in waste management, including the judicious use of paper, reduction in plastic usage, and proper disposal of waste according to categorized waste types.	Well-run
3	Secondary Stakeholders	<ol style="list-style-type: none"> 1. Food and plastic waste segregation is effectively carried out in the UMY canteen and cafeteria activities. 2. Proper waste disposal procedures are followed in laboratory settings. 3. Custodial staff ensures the cleanliness of waste areas within the university premises. 	Well-run

Source: Primary data, 2023

5 Conclusion

This paper analyzed the stakeholder’s engagement in waste management systems to achieve a sustainable campus, choosing UMY as a single case study. This study utilized a qualitative research method with a case study design. Data were gathered through an in-

depth-interview and documentation. The findings of this study identify strategies implemented by the stakeholders in managing waste in the university environments, including waste separation, waste collection and disposal, waste transportation, and waste processing and recycling. In addition, the findings reinforce the role of the stakeholders as the key, primary, and secondary stakeholders in waste management towards achieving a sustainable green campus.

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