An Analysis of Campus Waste Bank Management to Support Sustainable Development

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Abstract
This study focuses on analyzing the current management practices, challenges, and operational processes within campus waste banks, emphasizing on its contributions to environmental, social, and economic sustainability. The data was collected through interviews, observations, and document analysis to obtain insights into how the waste bank operates and aligns with sustainable development goals, particularly in waste reduction and recycling efforts. Further, this research explores potential improvements in the waste bank operations to enhance its impact on campus communities, and encourages students' waste practice responsibility. campus waste bank management has a significant impact on promoting environmental, economic, and social sustainability within the campus environment. The campus waste bank plays a key role in reducing waste volume through the 3R principles (Reduce, Reuse, Recycle), which simultaneously enhances environmental awareness and responsibility among students and the broader campus community. In addition to serving as a solution for waste management, the waste bank provides economic potential by converting waste into economic value for students and the campus community.
Keywords: *campus waste bank, sustainability, green campus, management*

Abstrak
Penelitian ini berfokus pada analisis praktik manajemen saat ini, tantangan, dan proses operasional dalam bank sampah kampus, dengan menekankan pada kontribusinya terhadap keberlanjutan lingkungan, sosial, dan ekonomi. Data dikumpulkan melalui wawancara, observasi, dan analisis dokumen untuk mendapatkan wawasan tentang bagaimana bank sampah beroperasi dan selaras dengan tujuan pembangunan berkelanjutan, khususnya dalam upaya pengurangan dan daur ulang sampah. Lebih lanjut, penelitian ini mengeksplorasi potensi peningkatan dalam operasi bank sampah untuk meningkatkan dampaknya terhadap komunitas kampus, dan mendorong tanggung jawab praktik sampah mahasiswa. Manajemen bank sampah kampus memiliki dampak signifikan dalam mempromosikan keberlanjutan lingkungan, ekonomi, dan sosial dalam lingkungan kampus. Bank sampah kampus memainkan peran kunci dalam mengurangi volume sampah melalui prinsip 3R (Reduce, Reuse, Recycle), yang secara bersamaan meningkatkan kesadaran dan tanggung jawab lingkungan di kalangan mahasiswa dan komunitas kampus yang lebih luas. Selain berfungsi sebagai solusi untuk pengelolaan sampah, bank sampah memberikan potensi ekonomi dengan mengubah sampah menjadi nilai ekonomi bagi mahasiswa dan komunitas kampus.
Kata kunci: *bank sampah kampus, keberlanjutan, kampus hijau, manajemen*

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INTRODUCTION

The campus environment is where students experience the learning process and carry out various activities. A good campus environment will certainly increase student learning motivation, lecturer teaching motivation, and other academic activities. Good waste management on campus is needed to create a good environment. However, good waste management is not just about creating a good environment (Viareco, 2023). Through a good waste management system, campus can become true learning centers about the importance of environmental awareness and sustainable practices. Students, lecturers, and campus staff can participate in waste sorting, recycling, and waste reduction practices. This not only provides real benefits for the campus environment, but also creates sustainable environmental awareness and responsibility within the campus community (Mukaromah, 2020).

As educational institutions that are respected and seen as leaders in society, universities have a social responsibility to provide examples of sustainable practices. By implementing good waste management, the location of a campus can influence the behavior and attitudes of the surrounding community, increase awareness of environmental problems, and encourage active participation in conservation activities (Abdulghaffar & Williams, 2021). Effective separation and recycling practices allow campus to reduce the amount of waste generated and reuse materials that still have value. This reduces the consumption of natural resources, reduces greenhouse gas emissions associated with the production of new materials, and reduces the impact on the natural environment (Dawodu, 2022). Good waste management on campus is one of the key factors in creating a green campus. Effective and sustainable waste management does not only include operational aspects such as sorting, recycling, and waste management systems but also requires the active participation of the entire campus community (Vargas & Campos, 2020). The importance of sustainable campus environment awareness is growing among educational institutions in Indonesia and other countries. This is driven by an increasingly comprehensive understanding of the global environmental challenges we face today, including climate change, biodiversity loss, and environmental degradation (Sharma, 2022). Universities play an important role in overcoming these challenges and become agents of change in building a sustainable campus environment. Through the green campus approach, educational institutions are starting to integrate social and economic aspects (Torrijos, Calvo Dopico, 2021). Several educational institutions have begun to develop campus environmental assessment tools such as the Sustainable University Model, Alternative University Assessment-Question Benchmark Indicators, and ranking systems such as GreenMetric (Magriotis., 2021).

Higher education is an element of urban educational institutions and has strategic roles to achieve Sustainable Development Goals through the Sustainable Campus Concept (Aprilia, 2021). The concept of a sustainable campus or green campus considers three aspects, i.e. economic, social, and environmental. This concept is derived from the UI Green metric to evaluate campus efforts to create a sustainable campus based on several factors. The components of a sustainable campus are Environment and Infrastructure, Waste, Water, Transportation, Energy, and Climate Change (Novikasari, 2024). Some attempts that universities can accomplish to achieve a sustainable campus are creating a university development plan that focuses on environmentally friendly infrastructure, involving the entire academic community to form a sustainable community, and developing research to achieve this goal. All of these may support the realization of a sustainable campus (Daglioglu, 2022). Besides, there is a necessity to socialize the concept of a green campus through research and education, concern for the environment by the entire academic community, protection of natural resources and reduction of pollutants, as well as campus design according to standards and user needs (Rugatiri, 2021).

Completing this goal requires a commitment to better management and cooperation of those entire active on campus to participate in protecting the campus environment, starting from lecturers, students, and those with interests on campus (Retariandalas & Pujiati, 2021). A comprehensive evaluation is required as a means of increasing awareness by assessing and comparing the extent of the education community's commitment to sustainable development, sustainable research, and greening campus and their social impacts (Prapanca, 2020). A derivative of the Sustainable Campus Concept is the Green Campus Concept. The Green Campus aims to integrate environmental knowledge into the university's policies, management, and Tridharma activities to preserve and protect the environment. To realize a green campus requires consideration of at least four aspects: spatial planning, environmental management, traffic management, and policy determination (Wahyuni, 2022). Through green campus, educational institutions produce scholars who are not only highly intellectual in the academic field but also have a love for the earth and its environment. The integration of science and environmental values into campus missions and programs will support the realization of sustainable development programs (Caputo, 2021). The things above underlie the need for good and integrated waste management so that campus can also obtain the benefits from waste, such as conversion into energy or by-products; for examples compost, electrical energy, and various craft products from waste (Hariz, 2018).

A campus waste bank is a voluntary recycling initiative implemented at institutions of higher education, like University of Putra Malaysia, promoting the collection of recyclables, raising awareness, and providing monetary rewards to encourage sustainable waste minimization practices among students (Fatma, et. al,, 2019). According to the previous research, the campus waste bank "BaSCamp," at STKIP PGRI Jombang aims to enhance waste management knowledge and skills through training in the 3R principles (Reduce, Reuse, Recycle), fostering environmental conservation and community engagement among students (Kahan, et. al, 2023). The campus waste bank at Diponegoro University, known as Dipo Waste Bank, facilitates waste sorting and recycling, managed by students. It operates through various periods, enhances community participation and optimizes waste management focusing on economic value and sustainability (Sumiyati, et. al., 2021). The Enviro Andalas Waste Bank at Andalas University manages dry waste through customer registration, transactions, and waste pick-up services, and utilizes a web and mobile-based information system to enhance efficiency and accuracy in waste management and customer satisfaction (Husni, et. al., 2021). The waste bank at Tanjungpura University integrates the 3R concept (Reuse, Reduce, Recycle) into the waste management system, promotes effective waste sorting, collection, and processing, ultimately contributes to the development of a Green Campus concept (Susilowati, 2023). The research highlights the Waste Bank as a medium for instilling character education values, particularly environmental care and creativity, in schools. It aims to empower students to manage waste and foster entrepreneurial skills, contribute to sustainable education and community independence (Ni Putu & Wina, 2024).

Waste Bank management is a community-based strategy that promotes waste reduction through the 4Rs concept (Reduce, Reuse, Recycle, and Replant). It engages citizens in waste management initiatives, aims for zero emissions and enhances urban environmental quality in Langsa City (Abus, et. al, 2024). Waste bank management involves mechanisms for waste delivery, types of economically valuable waste, recycling processes, and maggot cultivation. It enhances participants' skills in creating handicrafts and organic fertilizers, promotes environmental awareness and economic benefits through effective waste management practices (Danang, et. al., 2024). Waste bank management involves collecting and sorting dry waste, and functions like a bank where

waste is "saved" instead of money. It requires active community participation and aims to reduce waste generation, promotes a cleaner environment, and encourages residents' economic independence (Ana, et. al., 2024). Waste bank management involves efficiently handling waste through institutions that recycles materials (Mohamad, et. al., 2024).

The purpose of this research, titled "Analysis of Campus Waste Bank Management to Support Sustainable Development," is to assess the effectiveness of campus waste bank management systems and their roles in advancing sustainable development goals. This study aspires to identify the current practices and operational challenges in the campus waste bank management, analyzes their impact on the environmental, economic, and social dimensions of campus sustainability. Furthermore, the research aims to uncover the opportunities for enhancing waste bank operations to better align with sustainable principles, such as waste reduction, recycling, and community involvement. By providing recommendations to improve campus waste bank management, this study aspire to promote sustainable education, encourages students' environmental responsibility, and supports a circular economy within the campus. Ultimately, this research intends to offer practical insights for universities seeking to optimize their waste management practices and strengthen their commitment to sustainable development.

METHODS

This research uses a qualitative approach to examine waste management at Sebelas Maret University. The data was obtained through interviews with respondents and observations regarding the implementation of waste management. The interviews were conducted with a clear introduction until to make the respondents understood about the research topic. The observations were carried out to collect data regarding planning, implementation, and obstacles in implementing integrated and sustainable waste management. The data from interviews was described based on the situations and conditions observed and the identity of the respondents. The data analysis was done using interactive data analysis technique by Miles, Huberman & Saldana (2014) consisting of four stages, namely, data collection, data reduction, data presentation, and drawing conclusions.

RESULT AND DISCUSSION

The UNS Solo Waste Bank, managed by students, serves the UNS academic community who are confused about managing waste. Formed from the Student Creativity Program (PKM) in 2019 and in collaboration with PT Pegadaian, this waste bank was initially located outside campus, precisely in front of the UNS Solo flats. In line with the campus's green campus mission, the UNS Solo Waste Bank offers three programs: waste is exchanged for cash, exchange proceeds are saved in cash, or the form of gold. Even though it currently only accepts inorganic waste, the waste bank plans to process organic waste in the future. The UNS Solo Waste Bank is a solution for students in managing daily waste, and some of the waste is processed into marketable products. This movement invites all UNS academics to save waste with the various exchange options offered.

The UNS Solo Waste Bank is a social entrepreneurship engaged in waste management, especially inorganic waste. The concept of the UNS Solo Waste Bank is almost the same as conventional banks, but the UNS Solo Waste Bank accepts 'garbage' which is converted into cash. In addition, the UNS Solo Waste Bank also collaborates with PT Pegadaian with one of the cooperation products that has the slogan 'Sorting Waste, Saving Gold'.

The benefits of the waste bank in the campus environment are as a means of teaching students to process waste, increasing awareness and caring attitude towards the environment, especially household and campus waste. For students, the conversion of waste into cash can be one of the sources of income. In addition, the existence of the UNS Solo Waste Bank is a form of supporting the green campus program. The UNS Solo Waste Bank activities are in the form of operational waste acceptance every Thursday, socializing about the waste bank on the campus and outside the campus, and waste processing.

The waste management procedures at the UNS Solo Waste Bank involve several key steps that guide customers from waste sorting to the final recording of savings. Below is a detailed breakdown of each stage, including the weighing schedule:

1. Sorting the Inorganic Waste: customers begin by sorting their inorganic waste at home or their respective locations. The types of inorganic waste accepted by the waste bank are plastic, paper, metal, and glass. Sorting the waste by type is essential as it simplifies subsequent weighing and pricing.

Figure 1. Sorting the Inorganic Waste

2. Waste bank customers hand over to waste bank officers: after sorting the waste, customers bring their waste to the waste bank according to a pre-set schedule. The UNS Solo Waste Bank has specific collection days and designated pick-up points to facilitate the waste drop-off process for customers making it more convenient and organized.

Figure 2. Waste bank customers hand over to waste bank officers

3. Weighing the Waste: the weighing process takes place on the 2nd and 4th Thursdays of every month. At this stage, each type of waste is weighed separately using scales provided by the waste bank. This separation ensures accuracy in determining the weight of each waste category.

Figure 3. Weighing the Waste

4. Recording the Weighing Results: the weight of each type of waste is recorded in detail. The data that includes the waste type, weight, and price per kilogram is recorded. These records are essential for maintaining an accurate tracking system, as each type of waste has a different value based on the prevailing rates.

Figure 4. Recording the Weighing Results

5. Calculating the of Waste Exchange Value: Based on the recorded weight and type of waste, the value of the waste exchange is calculated. Each type of waste has a unique exchange rate, reflecting the current market price. This calculated value represents the worth of the waste brought by the customer.

Figure 5. Calculating the of Waste Exchange Value

6. Exchange Options and Savings: customers then decide how they want to use the exchange value of their waste. They can opt to save it in cash or as gold, with the

amount added to their account balance. This addition is documented either in the customer's saving book or in the waste bank's digital recording system, providing a transparent and traceable record of each transaction.

No	Jenis Sampah	Harga / Kg
1	Botol Plastik	1500
2	Gelas Plastik	2800
3	kARDUS	1800
4	duplex	800
5	kertas HVS	3000
6	Kertas Buram	1500
7	Kertas Koran	3000
8	Kertas Majalah	1500
9	Plastik Putih	1500
10	Plastik Warna	1500
11	Plastik Campur	1500
12	Plastik Keras	1000
15	Tutup Botol Plastik	3000
14	Tutup Galon	3000
15	Botol Sirup	200

No	Jenis Sampah	Harga / Kg
16	Alumunium	8500
17	Seng	1500
18	Galon Utuh	14000
19	Galon Pecah	6000
20	Emberan Warna	1500
21	Emberan Putih	2000
22	Kaleng	2000
23	Sak Semen	
24	Botol Kecap	1000
25	Besi	4000
26	Kabel	
27	Dengen	2000
28	Pralon	1500
29	Minyak Jelantah	4000
30		

Figure 6. Exchange Options and Savings

The UI GreenMetric World University Rankings also provide an opportunity for universities to consider their strengths and weaknesses in encouraging environmentally friendly universities and sustainable development. The ranking methodology is based on the six main categories, consisting of regulation and infrastructure, energy and climate change, waste management, water use, transportation, and environmental education (Pascawat, 2023). Although university rankings have become a global phenomenon in recent decades, they primarily focus on the importance of research and academic reputation, with little or no attention paid to environmental issues (Alshuwaikhat & Abubakar, 2008). Fortunately, green campus initiatives have gained significant momentum. In 2010, the University of Indonesia (UI) established the UI GreenMetricWorld University Rankings as a platform for universities around the world to share information and practices to achieve campus sustainability (Defriatno, 2024). Properly managing waste in the campus environment can be an educational example for the community, so that it can have economic, social and ecological value. The habitual formation of managing waste properly in the campus environment is later expected to be a pilot project, in this way, it can change the perception regarding the meaning of waste which is no longer a disgusting item or object that is just thrown away (Fauzi., 2024). The main goals of the waste management are improving the health of the campus environment and conserving natural resources, especially water. The waste management system essentially consists of subsystems that work together to achieve the goal of a clean, healthy and orderly campus (Rizki., 2023). Waste management also requires active participation and coordination of various stakeholders, including producers. The green campus model applied in the field of waste management in universities should consider the EPR concept (Handiwibowo & Lissa Rosdiana Noer, 2020). Waste management is based on the principles of responsibility, sustainability, profit, justice, recognition, integrity, safety, security, and economic value. Apart from using waste as a resource, waste management aims to improve public health and environmental quality (Wenny Desty Febrian & Agung Solihin, 2024). The campus TPS manager is responsible for further waste sorting, recycling, and coordinating with the waste bank. The waste bank managers are tasked with collecting waste and processing it at the waste bank in exchange for money. DLHK administrators are assigned to collect

the waste that cannot be processed by the campus TPS. Users play a role in purchasing and using recycled products from Campus TPS (Achmad Room Fitrianto et al., 2023) .

CONCLUSION

The conclusion of the research reveals that campus waste bank management has a significant impact on promoting environmental, economic, and social sustainability within the campus environment. The campus waste bank plays a key role in reducing waste volume through the 3R principles (Reduce, Reuse, Recycle), which simultaneously enhances environmental awareness and responsibility among students and the broader campus community. In addition to serving as a solution for waste management, the waste bank provides economic potential by converting waste into economic value for students and the campus community. Effective waste bank management, such as that observed at UNS Solo, which collaborates with PT Pegadaian to exchange waste for cash or gold, helps reinforce the green campus initiative promoted by the university. Through active student participation and external collaboration, the waste bank also serves as a medium for education and social empowerment, contributing positively to the development of environmental responsibility and awareness among the younger generation.

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