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The Contribution of Circular Economy Practices, Waste Management Literacy, and Infrastructure Support to the Sustainability of Urban Waste Management in Surabaya City

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ABSTRACT

Urban waste management has become a critical challenge in rapidly growing cities due to increasing population, urbanization, and consumption patterns that generate large volumes of waste. Sustainable waste management systems are therefore required to reduce environmental impacts and improve resource efficiency. This study aims to analyze the contribution of circular economy practices, waste management literacy, and infrastructure support to the sustainability of urban waste management in the City of Surabaya. The research employs a quantitative approach using a survey method. Data were collected from 150 respondents through a structured questionnaire measured using a five-point Likert scale. The collected data were analyzed using SPSS version 25, including descriptive statistics, validity and reliability testing, and multiple linear regression analysis. The results of the study indicate that circular economy practices, waste management literacy, and infrastructure support all have positive and significant effects on the sustainability of urban waste management. Waste management literacy shows the strongest influence on sustainability, followed by circular economy practices and infrastructure support. The regression analysis shows that the three independent variables collectively explain 54.9% of the variation in urban waste management sustainability. These findings suggest that improving public environmental knowledge, encouraging circular economy practices such as recycling and waste reduction, and strengthening waste management infrastructure can significantly enhance sustainable urban waste management. The study provides practical implications for policymakers and urban planners to develop integrated strategies that combine community participation, environmental education, and infrastructure development to achieve sustainable waste management systems.

Keywords: *Circular Economy, Waste Management Literacy, Infrastructure Support, Urban Waste Management, Sustainability*

1. INTRODUCTION

Urbanization and economic growth have significantly increased the volume of municipal solid waste in many cities around the world. Rapid population growth, changes in consumption patterns, and the expansion of urban economic activities have contributed to rising waste generation, creating major challenges for urban environmental sustainability [1], [2]. Cities in developing countries often face additional difficulties in managing waste due to limited infrastructure, insufficient public awareness, and weak integration of sustainable waste management systems [3], [4]. As a result, urban waste management has become a critical issue in achieving sustainable development, particularly in densely populated metropolitan areas where waste generation continues to escalate alongside economic activity.

Surabaya, one of the largest metropolitan cities in Indonesia, represents a prominent example of an urban area facing these challenges. As a major hub of economic, industrial, and commercial activities, Surabaya produces a substantial volume of municipal waste every day [5], [6]. The local government has introduced several initiatives to address this issue, including the establishment of waste banks, recycling programs, and community-based environmental campaigns

aimed at encouraging waste reduction and segregation [7]. Despite these efforts, the continuous growth in waste generation still places considerable pressure on existing waste management systems, indicating the need for more integrated and sustainable strategies that involve government institutions, community participation, and supporting infrastructure.

In recent years, the concept of the circular economy has emerged as an important framework for promoting sustainable waste management. Unlike the traditional linear economic model characterized by the "take–make–dispose" pattern, the circular economy emphasizes waste reduction, resource efficiency, and the reintegration of materials into the production cycle through reuse and recycling [8], [9]. By transforming waste into valuable resources, circular economy practices can significantly reduce dependence on landfills, mitigate environmental pollution, and enhance resource sustainability in urban environments. Consequently, many cities around the world have begun to integrate circular economy principles into their waste management policies and practices.

However, the effectiveness of circular economy implementation in urban waste management largely depends on the level of public awareness and knowledge related to waste management practices. Waste management literacy plays a crucial role in shaping environmentally responsible behavior among citizens. Individuals with adequate knowledge about waste sorting, recycling, composting, and responsible consumption are more likely to participate actively in sustainable waste management initiatives. Conversely, limited understanding of waste management practices often leads to improper waste disposal behavior, which undermines the effectiveness of municipal waste management policies and programs.

Beyond behavioral and knowledge-related aspects, the availability of appropriate infrastructure is also a key determinant in the success of sustainable waste management systems. Infrastructure support includes waste collection systems, waste sorting facilities, recycling centers, composting facilities, and transportation networks that facilitate efficient waste management operations [10], [11]. Adequate infrastructure enables communities to implement proper waste segregation and recycling practices more effectively, thereby supporting the broader implementation of circular economy principles. In contrast, insufficient infrastructure may limit the effectiveness of waste management initiatives, even when community awareness and willingness to participate are relatively high.

Previous studies have highlighted that sustainable urban waste management requires the integration of environmental awareness, community participation, and institutional support. Circular economy initiatives have been shown to improve resource efficiency and reduce waste generation, while environmental literacy has been identified as an important factor influencing pro-environmental behavior. Infrastructure availability is also widely recognized as a critical enabling factor for effective waste management systems. Nevertheless, empirical studies that simultaneously examine the combined influence of circular economy practices, waste management literacy, and infrastructure support on the sustainability of urban waste management remain relatively limited, particularly in the context of Indonesian metropolitan cities such as Surabaya. Therefore, this study aims to analyze the contribution of circular economy practices, waste management literacy, and infrastructure support to the sustainability of urban waste management in Surabaya. The findings are expected to provide both theoretical insights and practical implications for policymakers in developing more integrated and sustainable urban waste management strategies.

2. LITERATURE REVIEW

2.1 Circular Economy Practices

The circular economy has emerged as an alternative economic model designed to reduce environmental degradation and promote sustainable resource utilization. Unlike the traditional linear model characterized by the "take–make–dispose" pattern, the circular economy emphasizes maintaining the value of products, materials, and resources for as long as possible through strategies such as reuse, recycling, remanufacturing, and waste reduction [8], [9]. In the context of waste management, this approach encourages communities, industries, and governments to transform waste into valuable resources through practices such as waste sorting, recycling, composting, and material recovery [11], [12]. These practices not only reduce landfill dependency and environmental pollution but also create economic opportunities through recycling industries and green job development. As major centers of production and consumption, urban areas play a crucial role in implementing circular economy principles through policies such as recycling programs, waste banks, and responsible consumption initiatives, which have been shown to improve resource efficiency and support sustainable urban waste management.

2.2 Waste Management Literacy

Waste management literacy refers to the level of knowledge, awareness, and understanding that individuals possess regarding proper waste handling practices, including waste segregation, recycling, composting, waste reduction strategies, and the environmental impacts of improper waste disposal [13], [14]. This literacy plays a crucial role in shaping pro-environmental behavior within communities because individuals who understand the consequences of waste pollution and the benefits of sustainable waste practices are more likely to adopt responsible behaviors such as separating organic and inorganic waste [15], [16]. Environmental education programs and public awareness campaigns are commonly used to enhance waste management literacy and encourage community participation in recycling initiatives, waste bank programs, and environmental campaigns. Previous studies indicate that communities with higher levels of environmental literacy tend to demonstrate stronger engagement in waste management activities and exhibit more positive environmental attitudes. Consequently, improving waste management literacy is considered a key strategy for fostering responsible environmental behavior and strengthening the sustainability of urban waste management systems.

2.3 Infrastructure Support in Urban Waste Management

Infrastructure support refers to the physical facilities, technological systems, and institutional resources that enable effective waste management in urban areas. This includes waste collection systems, waste sorting facilities, recycling centers, composting facilities, waste transportation vehicles, and sanitary landfills that ensure waste can be properly collected, transported, processed, and disposed of in an environmentally responsible manner [17], [18]. The availability of adequate infrastructure greatly influences the success of waste management programs because even when communities have high environmental awareness, the lack of appropriate facilities—such as waste sorting bins or recycling centers—can hinder proper waste handling

practices [19], [20]. In addition, infrastructure support also involves technological innovations and institutional frameworks, including smart waste management systems and improved waste collection logistics, which enhance operational efficiency and reduce environmental impacts. Studies have shown that cities with well-developed waste management infrastructure tend to achieve higher recycling rates, lower landfill dependency, and better environmental outcomes, indicating that infrastructure support is a key enabling factor in implementing sustainable and circular waste management systems.

2.4 Sustainability of Urban Waste Management

Sustainable waste management refers to the systematic handling of waste in ways that minimize environmental impacts, promote resource efficiency, and support long-term ecological balance. It aims to reduce waste generation, maximize recycling and resource recovery, and ensure that waste disposal practices do not harm the environment or public health [21], [22]. In urban environments, achieving sustainable waste management requires the integration of multiple components, including effective environmental policies, active community participation, technological innovation, and strong institutional support. The sustainability of waste management systems depends not only on government initiatives but also on citizens' engagement and the availability of adequate infrastructure. Common indicators of sustainable waste management include waste reduction levels, recycling rates, community participation in waste programs, environmental awareness, and the efficiency of waste collection systems [23], [24]. Moreover, the integration of circular economy practices, waste management literacy, and infrastructure support is increasingly recognized as a comprehensive strategy to enhance sustainable waste management, as circular economy practices encourage resource recovery, environmental literacy strengthens public participation, and infrastructure provides the facilities needed to implement these practices effectively.

2.5 Hypothesis Development

Based on the theoretical and empirical discussions presented above, this study proposes several hypotheses regarding the relationships between circular economy practices, waste management literacy, infrastructure support, and the sustainability of urban waste management. Circular economy practices encourage waste reduction, recycling, and resource recovery, which are expected to directly contribute to the development of sustainable waste management systems. In addition, waste management literacy enhances public knowledge and awareness regarding responsible waste handling practices, thereby increasing community participation in waste sorting, recycling, and other sustainability initiatives. Infrastructure support also plays a crucial role by providing the necessary facilities and systems—such as waste collection, sorting, and recycling infrastructure—that enable effective waste management operations. Therefore, it is expected that circular economy practices, waste management literacy, and infrastructure support individually and collectively contribute to strengthening the sustainability of urban waste management systems.

H1: Circular economy practices have a positive and significant effect on the sustainability of urban waste management.

H2: Waste management literacy has a positive and significant effect on the sustainability of urban waste management.

H3: Infrastructure support has a positive and significant effect on the sustainability of urban waste management.

H4: Circular economy practices, waste management literacy, and infrastructure support simultaneously have a positive and significant effect on the sustainability of urban waste management.

3. METHODS

3.1 Research Design

This study employs a quantitative research approach to examine the influence of circular economy practices, waste management literacy, and infrastructure support on the sustainability of urban waste management in the City of Surabaya. A quantitative approach is used because it enables the objective measurement of relationships between variables through statistical analysis. The research adopts a cross-sectional survey design, in which data are collected from respondents at a single point in time using a structured questionnaire. The survey method is considered appropriate because it allows the collection of primary data directly from community members regarding their perceptions, knowledge, and behaviors related to waste management. The data obtained are subsequently analyzed using statistical techniques to identify and evaluate the relationships between the independent variables and the dependent variable.

3.2 Research Variables

This study examines one dependent variable and three independent variables. The independent variables include circular economy practices (X1), waste management literacy (X2), and infrastructure support (X3), while the dependent variable is the sustainability of urban waste management (Y). Circular economy practices refer to community behaviors and activities related to waste reduction, reuse, recycling, and resource recovery that emphasize efficient material use and the transformation of waste into valuable resources. Waste management literacy represents the level of knowledge, awareness, and understanding individuals possess regarding proper waste management practices, including waste sorting, recycling, composting, and environmental responsibility. Infrastructure support refers to the availability and adequacy of facilities and systems that enable effective waste management, such as waste collection services, recycling facilities, waste sorting bins, and waste transportation systems. Meanwhile, the sustainability of urban waste management reflects the effectiveness and continuity of waste management practices aimed at reducing waste generation, increasing recycling activities, and promoting environmentally responsible waste handling in urban areas.

3.3 Population and Sample

The population of this study consists of residents living in the City of Surabaya who are involved in daily waste management activities at the household or community level. Due to the large population size, a sampling technique is employed to obtain representative respondents. This research applies purposive sampling, where respondents are selected based on specific criteria, such as individuals who are familiar with waste management activities or have participated in environmental programs within their communities. A total of 150 respondents participated in this study, which is considered sufficient for quantitative analysis using multiple regression techniques. The respondents represent diverse demographic backgrounds within the urban community of Surabaya.

3.4 Data Collection Techniques

The primary data used in this research were collected through a structured questionnaire distributed to respondents to measure their perceptions and experiences related to circular economy practices, waste management literacy, infrastructure support, and the sustainability of urban waste management. All questionnaire items were assessed using a five-point Likert scale that allows respondents to indicate their level of agreement with each statement, where 1 represents strongly disagree, 2 disagree, 3 neutral, 4 agree, and 5 strongly agree. The questionnaire consists of several statements representing each research variable, and prior to the data collection process, the instrument was reviewed to ensure the clarity, relevance, and appropriateness of the questions for the respondents.

3.5 Operational Definition of Variables

To ensure that each variable can be measured effectively, this study defines several indicators for each variable. The operational definitions of the variables are presented in Table 1.

Table 1. Operational Definition of Variables

Variable	Indicators
Circular Economy Practices (X1)	Waste reduction behavior, recycling practices, reuse of materials, participation in waste bank programs
Waste Management Literacy (X2)	Knowledge of waste sorting, awareness of environmental impacts, understanding of recycling practices, awareness of sustainable waste management
Infrastructure Support (X3)	Availability of waste bins, recycling facilities, waste collection systems, accessibility of waste management services
Sustainability of Urban Waste Management (Y)	Waste reduction effectiveness, recycling participation, environmental cleanliness, long-term waste management sustainability

These indicators were translated into several questionnaire items that represent each research variable.

3.6 Data Analysis Techniques

The collected data were processed and analyzed using the Statistical Package for the Social Sciences (SPSS) version 25 through several statistical techniques. Descriptive statistics were first used to describe respondent characteristics and summarize responses to each questionnaire item. A validity test was conducted using the Pearson correlation method to determine whether each questionnaire item accurately measured the intended variables by comparing the correlation value of each item with the critical value. A reliability test was also performed using Cronbach's Alpha coefficient to evaluate the consistency of the measurement instrument, where a value greater than 0.70 indicates acceptable reliability. Furthermore, multiple linear regression analysis was applied to examine the influence of circular economy practices (X1), waste management literacy (X2), and infrastructure support (X3) on the sustainability of urban waste management (Y), expressed in the regression model $Y=\alpha+\beta1X1+\beta2X2+\beta3X3+\varepsilon$, where α represents the constant, $\beta1,\beta2,\beta3$ are regression coefficients, and ε is the error term. Hypothesis testing was conducted using the t-test to analyze the partial effect of each independent variable and the F-test to evaluate the simultaneous effect of all independent variables on the dependent variable, with a significance level of $\alpha=0.05$, in order to determine whether circular economy practices, waste management literacy, and infrastructure support significantly contribute to the sustainability of urban waste management in Surabaya.

4. RESULTS AND DISCUSSION

4.1 Respondent Characteristics

This study involved 150 respondents who reside in the City of Surabaya. The respondents were selected from various community backgrounds to obtain a comprehensive understanding of

public perceptions regarding urban waste management practices. The demographic characteristics of the respondents include gender, age, education level, and occupation.

Table 1. Respondent Demographic Characteristics (n = 150):

Characteristics	Category	Frequency	Percentage (%)
Gender	Male	72	48.0
	Female	78	52.0
Age	18–25 years	35	23.3
	26–35 years	48	32.0
	36–45 years	39	26.0
	>45 years	28	18.7
Education	High School	52	34.7
	Diploma	28	18.7
	Bachelor	56	37.3
	Postgraduate	14	9.3
Occupation	Private Employee	55	36.7
	Government Employee	24	16.0
	Entrepreneur	29	19.3
	Student	22	14.7
	Others	20	13.3

Table 1 presents the demographic characteristics of the 150 respondents involved in this study. Based on gender distribution, the respondents consist of 78 females (52.0%) and 72 males (48.0%), indicating a relatively balanced participation between male and female respondents. In terms of age, the largest proportion of respondents falls within the 26–35 years age group (32.0%), followed by those aged 36–45 years (26.0%), 18–25 years (23.3%), and over 45 years (18.7%). Regarding educational background, most respondents hold a bachelor's degree (37.3%), followed by high school graduates (34.7%), diploma holders (18.7%), and postgraduate degree holders (9.3%). In terms of occupation, the majority of respondents are private employees (36.7%), followed by entrepreneurs (19.3%), government employees (16.0%), students (14.7%), and other occupations (13.3%). Overall, these demographic characteristics indicate that the respondents represent a diverse segment of the urban population in Surabaya, providing a broad perspective on community involvement in urban waste management practices.

4.2 Descriptive Statistics of Research Variables

Descriptive statistical analysis was conducted to examine the general tendencies of respondents' perceptions regarding circular economy practices, waste management literacy, infrastructure support, and the sustainability of urban waste management.

Table 2. Descriptive Statistics of Research Variables

Variable	N	Min	Max	Mean	Std. Deviation
Circular Economy Practices (X1)	150	2.40	4.85	3.96	0.53
Waste Management Literacy (X2)	150	2.50	4.90	4.08	0.48
Infrastructure Support (X3)	150	2.20	4.70	3.82	0.56
Urban Waste Management Sustainability (Y)	150	2.60	4.88	4.02	0.50

Table 2 presents the descriptive statistics of the research variables based on responses from 150 participants. The results indicate that waste management literacy (X2) has the highest mean value (4.08) with a standard deviation of 0.48, suggesting that respondents generally possess a relatively high level of knowledge and awareness regarding proper waste management practices. This is followed by urban waste management sustainability (Y) with a mean of 4.02 and a standard deviation of 0.50, indicating that respondents perceive the sustainability of waste management efforts in Surabaya to be relatively positive. Circular economy practices (X1) show a mean value of 3.96 with a standard deviation of 0.53, reflecting that the adoption of practices such as waste

reduction, reuse, and recycling among the community is moderately high. Meanwhile, infrastructure support (X3) records the lowest mean value (3.82) with a standard deviation of 0.56, suggesting that although infrastructure is generally considered adequate, there are still perceived gaps in the availability or effectiveness of waste management facilities. Overall, the relatively high mean scores across all variables indicate a positive perception among respondents toward circular economy practices, waste management literacy, infrastructure support, and the sustainability of urban waste management in Surabaya.

4.3 Validity Test

The validity test was conducted using Pearson correlation to determine whether each questionnaire item appropriately measures the intended variable. An item is considered valid if the correlation value (r-count) is greater than the r-table value (0.160 for n=150 at α=0.05).

Table 3. Validity Test Results

Variable	Item Code	r-count	r-table	Result
Circular Economy Practices	X1.1	0.673	0.160	Valid
	X1.2	0.712	0.160	Valid
	X1.3	0.689	0.160	Valid
	X1.4	0.705	0.160	Valid
Waste Management Literacy	X2.1	0.741	0.160	Valid
	X2.2	0.726	0.160	Valid
	X2.3	0.768	0.160	Valid
	X2.4	0.734	0.160	Valid
Infrastructure Support	X3.1	0.694	0.160	Valid
	X3.2	0.708	0.160	Valid
	X3.3	0.681	0.160	Valid
	X3.4	0.720	0.160	Valid
Sustainability	Y1	0.749	0.160	Valid
	Y2	0.721	0.160	Valid
	Y3	0.734	0.160	Valid
	Y4	0.742	0.160	Valid

Table 3 presents the results of the validity test for all questionnaire items used in this study. The results indicate that all measurement items across the four variables—circular economy practices, waste management literacy, infrastructure support, and urban waste management sustainability—have r-count values that are higher than the r-table value of 0.160. Specifically, the r-count values for circular economy practices range from 0.673 to 0.712, for waste management literacy from 0.726 to 0.768, for infrastructure support from 0.681 to 0.720, and for sustainability from 0.721 to 0.749. Since all r-count values exceed the critical r-table threshold, each questionnaire item is considered valid and capable of accurately measuring the intended research variables. These results indicate that the measurement instrument used in this study has satisfactory construct validity and is appropriate for further statistical analysis.

4.4 Reliability Test

Reliability testing was conducted using Cronbach's Alpha to determine the internal consistency of the research instrument.

Table 4. Reliability Test Results

Variable	Cronbach's Alpha	Standard	Result
Circular Economy Practices	0.842	>0.70	Reliable
Waste Management Literacy	0.865	>0.70	Reliable

Infrastructure Support	0.833	>0.70	Reliable
Waste Management Sustainability	0.851	>0.70	Reliable

Table 4 presents the results of the reliability test for all variables examined in this study. The findings indicate that all variables have Cronbach's Alpha values above the accepted reliability threshold of 0.70, demonstrating that the measurement instruments used are reliable. Specifically, circular economy practices show a Cronbach's Alpha value of 0.842, waste management literacy records the highest value at 0.865, infrastructure support has a value of 0.833, and waste management sustainability shows a value of 0.851. These results indicate that the questionnaire items used to measure each variable have a high level of internal consistency and are capable of producing stable and consistent responses from respondents. Therefore, the research instrument can be considered reliable and suitable for further statistical analysis in examining the relationships among the studied variables.

4.5 Multiple Linear Regression Analysis

Multiple regression analysis was conducted to determine the effect of circular economy practices, waste management literacy, and infrastructure support on the sustainability of urban waste management.

Table 5. Multiple Regression Analysis Results

Variable	Coefficient (B)	Std. Error	t-value	Sig.
Constant	0.874	0.342	2.556	0.012
Circular Economy Practices (X1)	0.318	0.081	3.925	0.000
Waste Management Literacy (X2)	0.356	0.089	4.002	0.000
Infrastructure Support (X3)	0.274	0.078	3.513	0.001

The regression analysis results produce the equation Y=0.874+0.318X1+0.356X2+0.274X3, indicating that circular economy practices (X1), waste management literacy (X2), and infrastructure support (X3) all have positive effects on the sustainability of urban waste management (Y). The positive regression coefficients suggest that improvements in these variables are associated with higher levels of sustainable waste management in Surabaya. The t-test results further show that circular economy practices significantly influence urban waste management sustainability ($t = 3.925$, $p < 0.05$), waste management literacy also has a significant effect ($t = 4.002$, $p < 0.05$), and infrastructure support significantly contributes as well ($t = 3.513$, $p < 0.05$). These findings indicate that all independent variables have a statistically significant influence on the dependent variable, confirming that hypotheses H1, H2, and H3 are accepted.

4.6 Coefficient of Determination (R^2)

The coefficient of determination was calculated to measure how much variance in the dependent variable can be explained by the independent variables.

Table 6. Model Summary

Model	R	R Square	Adjusted R Square	Std. Error
1	0.741	0.549	0.539	0.337

The R^2 value of 0.549 indicates that 54.9% of the variation in urban waste management sustainability can be explained by circular economy practices, waste management literacy, and infrastructure support. The remaining 45.1% is influenced by other variables not examined in this study.

Discussion

The findings of this study demonstrate that circular economy practices significantly contribute to the sustainability of urban waste management in Surabaya. This result indicates that activities such as waste reduction, recycling, and material reuse play a crucial role in minimizing landfill dependency and promoting more efficient resource utilization. Communities that adopt circular economy practices are able to transform waste into valuable resources, thereby reducing environmental pressures and improving the overall effectiveness of waste management systems. These findings support the argument that circular economy approaches are an essential strategy for addressing urban waste challenges in rapidly growing cities [25], [26].

In addition to circular economy practices, the results reveal that waste management literacy has the strongest influence among the independent variables examined in this study. This suggests that public knowledge and awareness regarding waste management practices are fundamental in shaping environmentally responsible behavior. Individuals who understand the environmental consequences of improper waste disposal are more likely to engage in activities such as waste segregation, recycling, and responsible consumption. Higher levels of environmental literacy therefore encourage stronger community participation in sustainable waste management initiatives.

The study also finds that infrastructure support significantly influences the sustainability of urban waste management. Adequate infrastructure, including waste sorting facilities, recycling centers, and efficient waste collection systems, enables communities to implement proper waste management practices more effectively. Without sufficient infrastructure, even individuals with high levels of environmental awareness may face difficulties in practicing responsible waste handling [27], [28]. Therefore, infrastructure serves as a critical enabling factor that facilitates the successful implementation of sustainable waste management programs.

Overall, the findings emphasize that sustainable urban waste management requires an integrated approach that combines behavioral, educational, and infrastructural components. Circular economy practices provide a framework for resource efficiency and waste reduction, waste management literacy strengthens community awareness and participation, and infrastructure support ensures that waste management systems function effectively. The synergy among these three elements plays an important role in improving the long-term sustainability of waste management systems in urban environments.

From a policy perspective, these results highlight the importance of implementing comprehensive strategies that integrate environmental education programs, strengthen circular economy initiatives, and improve waste management infrastructure. Local governments should promote public awareness campaigns, encourage community-based recycling programs, and invest in modern waste management facilities to support sustainable urban development. By adopting a more holistic approach, cities such as Surabaya can enhance their capacity to develop environmentally responsible and sustainable waste management systems.

CONCLUSION

This study examined the influence of circular economy practices, waste management literacy, and infrastructure support on the sustainability of urban waste management in the City of Surabaya using a quantitative research approach. The findings indicate that all three variables have positive and significant effects on sustainable waste management practices. Circular economy practices encourage waste reduction, reuse, and recycling within communities, thereby helping reduce the volume of waste sent to landfills and improving resource efficiency. Waste management literacy plays a crucial role in increasing public awareness and knowledge regarding environmentally responsible waste handling behaviors, while infrastructure support—such as waste collection systems and recycling facilities—enables communities to implement proper waste management practices more effectively. The regression analysis further shows that these variables collectively explain a substantial portion of the variation in waste management sustainability, with waste management literacy demonstrating the strongest influence, highlighting the importance of

environmental education. Overall, the results suggest that sustainable urban waste management can be strengthened through the promotion of circular economy initiatives, improvements in public environmental literacy, and the development of adequate waste management infrastructure, thereby supporting the creation of more efficient, environmentally responsible, and sustainable waste management systems in urban areas such as Surabaya.

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