International Journal of Technology and Education Research

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E-ISSN: 2986-0733

Analysis Of Waste Generation Rates In Watu-Watu Village, West Kendari District, Kendari City

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Abstract

The objective of this study is to analyze and project waste generation in Watu-Watu Village. The research was conducted from April to July 2025. The data collection method used in this study was quantitative data. The data collection techniques employed in this study included weighing waste from 44 households, interviews with residents, observation, documentation, and a literature review. The data sources for this study were secondary data. The results of the study indicate that Watu-Watu Village consists of 1,257 households with a total population of 3,596. There are 44 households comprising 223 residents. The weight of waste generated by these 44 households is 45 kg, providing an indication of the waste weight per small household group. The weight of organic waste is 0.037 kg and inorganic waste is 0.16 kg, which are key indicators for determining the weight of organic and inorganic waste per day, month, or year. Overall, the daily waste weight per person is 0.19 kg, which is a crucial indicator for calculating waste projections per person per day. Total annual waste generation reaches 16,034,851 tons, which is an annual projection based on daily data. The conclusion of this study is that the analysis of waste generation in Watu-Watu Village shows an average household waste generation of 0.19 kg per person per day. The waste composition is dominated by inorganic waste (0.16 kg/day), which is higher than organic waste (0.037 kg/day). The total combined generation of organic and inorganic waste reaches 45 kg. The projected waste generation in Watu-Watu Village for the year 2030 is 415.53 tons/day and151,668.45 tons/year. This projection is based on population projections indicating a decrease per year from 2025 to 2030, with a population of 2,187 people in 2030.

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KEYWORDS: ***Composition, Generation Rate, Waste, Watu-Watu***

INTRODUCTION

Currently, the waste problem remains one of the challenges that must be urgently addressed in Indonesia; waste generated from human activities continues to increase in volume alongside rising population, consumption levels, and technological advancements. Waste that is not properly managed will lead to environmental and public health issues (Sholihah, 2020).

The current waste problem is a social issue that requires attention from all parties, as every person inevitably produces waste, yet at the same time, the public does not want to be near it. Meanwhile, existing waste collection sites will not be able to accommodate the continuous flow of waste generated by the public unless the public begins to take action to reduce the amount of waste they produce (Pramono et al., 2024).

Waste is any solid material or object that is no longer used by humans, or any solid object that is no longer used in human activities and is discarded. Waste is something that is unused, unneeded, unwanted, or discarded, originating from human activities, and does not occur naturally. From this definition, it is clear that waste is the result of human activities that is discarded because it is no longer useful (Watiningsih et al., 2024).

In general, waste can be divided into two categories: organic/wet waste and inorganic/dry waste. As the population grows, the volume of waste in the environment also increases. Consumer patterns also contribute to the increase in waste volume, which is becoming increasingly diverse in type (Tamyiz et al., 2018).

report from the Ministry of Environment and Forestry of the Republic of Indonesia (MEFRI) via the National Waste Management Information System (NWMIS) indicates that in 2024, the total amount of waste generated was 29,373,851.86 million tons per year. Of this total waste, only 61.59% per year is successfully managed, leaving 38.41% per year of waste that has not been properly managed.

Waste management is a systematic, comprehensive, and continuous process that encompasses waste reduction and disposal. Waste management efforts include: waste reduction and waste disposal. Everyone is required to participate in waste reduction and disposal. Waste handling includes the following activities: sorting, collection, transportation, treatment, and final processing of waste. Meanwhile, waste treatment includes the following activities: compaction, composting, material recycling, and converting waste into an energy source (Sudiro et al., 2018).

Effective waste management must include proper waste sorting, including the

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separation of organic waste, plastic, paper, and metal. This sorting makes it possible to recycle and process waste more efficiently, reducing the volume of waste sent to landfills and minimizing its negative impact on the environment (Faristiana et al., 2023).

The 3R waste management model is an approach that emphasizes three key steps in waste management: Reduce, Reuse, and Recycle. “Reduce” means striving to minimize the amount of waste generated from the outset. Examples include choosing products with minimal packaging, bringing your own shopping bags, and reducing the use of single-use items. Reuse (reusing). Waste management is essential to minimize negative impacts. Accumulated waste without proper management can lead to problems such as disease and the production of hazardous chemicals (Sekarningrum et al., 2020).

Kendari is a city in Southeast Sulawesi Province that continues to experience population growth, reaching 366,454 residents (Kendari City BPS, 2024). According to data (SIPSN, 2024), Kendari City generates an average of 255.82 tons of waste daily and 93,375.91 tons per year, not including waste found in illegal dumping sites. According to NWMIS, the largest category of waste in Kendari City is food scraps at 52.19%, followed by wood and branches (12.69%), metal (1.55%), textiles (1.30%), rubber and leather (1.65%), glass (1.87%), and others (7.23%). This indicates that waste management in Kendari City has not yet been managed optimally.

Administratively, Kendari City consists of 11 subdistricts, one of which is West Kendari Subdistrict, which ranks third with a population density of 41,857 people; the top position is held by Poasia Subdistrict, which has a population density of 45,444 people, followed by Puuwatu Subdistrict in second place with a population density of 44,812 people (Kendari City BPS, 2024). The population, which continues to grow each year, contributes to an increase in waste generation. This can lead to environmental problems; furthermore, the public’s low level of knowledge and awareness regarding the proper management and reduction of waste production exacerbates the rate of waste generation (Hapsari et al., 2024).

Administratively, Watu-Watu Village is located in West Kendari District. This village has a high population density, with a population of 3,596 people (BPS City of Kendari, 2024). Based on population data in Watu-Watu Village, which has shown a continuous increase year over year, this trend is supported by data from the Kendari City BPS indicating a significant increase in the population from 2019 to 2023. Population growth is influenced by three main factors. First is the number of live births in a population, which directly increases the population size; second is mortality, or the number of deaths in a population, which reduces the population size. Mortality rates are influenced by health quality, environmental conditions, natural disasters, life expectancy, and the spread of infectious diseases. Third, migration, which is the movement

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of people between regions. Inward migration (immigration) increases the population, while outward migration (emigration) decreases it. Factors influencing migration include economic, social, political, environmental, and personal reasons. Overall, population growth is the result of the difference between births and deaths, plus the difference between immigration and emigration. (Suama et al., 2024).

Based on initial observations on February 11, 2025, waste management in Watu-Watu Village is currently not optimal and requires proper handling and management, starting from the sorting, collection, and transportation processes. On the other hand, the limited capacity of the Waste Collection Site (WCS) and the limited frequency of collection result in waste exceeding the site's storage capacity. Therefore, based on the background described above, the researcher is interested in conducting a study on "Analysis of Waste Generation Rates in Watu-Watu Village, West Kendari Subdistrict, Kendari City."

RESEARCH METHOD

Place and Time of Research

This study was conducted in Watu-Watu Village, West Kendari District, Kendari City, which is geographically located at 3° 57' 19" S, 122° 32' 29" E. The study was conducted from April to July 2025.

Materials and Tools

The materials used in this study were organic and inorganic waste. The tools used in this study included a scale for weighing waste, packing bags for collecting organic and inorganic waste, a camera for field documentation, gloves to protect hands while sorting organic and inorganic waste, writing utensils to record interview results, and masks as respiratory protection during waste sorting.

Research Sample

The population in this study consists of the entire community of Watu-Watu Village, West Kendari Subdistrict, Kendari City, totaling 3,596 people. The sample size of 44 people was determined using the Slovin formula (e = 15%) with the desired margin of error.

Results and Discussion

The following table shows waste generation based on waste weight per person per day in Watu-Watu Village, as shown in Table 1 below:

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Table 1. Waste generation based on waste weight (kg/person/day)

Total Waste Generation	kg/person
Organic Waste Weight/Person	0.037 kg
Inorganic Waste Weight per Person	0.16 kg
Total Organic and Inorganic Waste Generation / Day	43.931 kg
Total Annual Waste Generation	16,034.851 tons

Source: Primary data, processed 2025

The table above shows that Watu-Watu Village consists of 1,257 households with a total population of 3,596. There are 44 households comprising 223 people. The weight of waste generated by these 44 households is 45 kg, providing an indication of the waste weight per small household group. The weight of organic waste is 0.037 kg and inorganic waste is 0.16 kg, which are key indicators for determining the weight of organic and inorganic waste per day, month, or year. Overall, the daily waste weight per person is 0.19 kg, which is a crucial indicator for calculating waste projections. The total daily waste generation is 43,931 kg, which is the total accumulated waste from all samples. The total annual waste generation reaches 16,034.851 tons. This is an annual projection based on daily data.

The following table shows the composition of household waste by source in Watu-Watu Village, as presented in Table 2 below:

Table 2. Composition of Household Waste by Source in Watu-Watu Subdistrict

Waste Generation	kg/day	%	kg/month	%	kg/year	%
Inorganic	35.68	81%	1,070.40	81%	390,696.00	81%
Organic	8,251	19%	247.53	19%	90,348.45	19%
Total	43,931	100%	1,317.93	100%	16,034.851	100%

Source: Primary data, processed in 2025

Table 2 above shows the results of the composition of organic and inorganic household waste in Watu-Watu Village. The largest portion of the waste is inorganic waste, amounting to (35.68 kg/day) (1,070.40 tons/month) and (390,696.00 tons/year), while the remainder is organic waste, amounting to (8,251 kg/day), (247.53 tons/month), and (90,348.5 tons/year). This results in a total average of 16,034.851 tons/year.

The population projection in this study uses mathematical methods, including both

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arithmetic and geometric models to estimate the population size. Of these two methods, the arithmetic method was selected based on the lowest standard deviation and a correlation coefficient approaching 1. The results of the standard deviation calculations are shown in Table 3 below:

Table 3. Standard Deviation Results of the Arithmetic Method for Population Projections

Method	Standard Deviation	Correlation Coefficient
Arithmetic	662.8924545	0.631059369

Source: Primary data, processed in 2025

After the population projection method has been determined, the next step is to calculate the population projection for West Kendari Subdistrict for the next 6 years (2025–2030). The results of the population projection calculations can be seen in Table 4 below:

Table 4. Population Projections for Watu-Watu Subdistrict, 2025–2030

No.	Year	Population (People)
1.	2025	3,310
2.	2026	3046
3.	2027	2804
4.	2028	2581
5.	2029	2376
6.	2030	2187

Source: Primary data, processed in 2025

Table 4 Shows that in 2025 the population of Watu-Watu Village was 3,310 and is projected to reach 2,187 in 2030, indicating a significant decline in population.

The following table shows the projected waste generation in Watu-Watu Village, as presented in Table 5. below:

Table 5. Projected Amounts of Organic and Inorganic Waste Generation

Year	Population (People)	Daily Waste Generation (kg)	Annual Waste Generation (kg)
2025	3,310	682.90	229,548.5
2026	3,046	578.74	211,240.1

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E-ISSN: 2986-0733

2027	2,804	532.76	194,457.4
2028	2,581	490.39	178,992.35
2029	2,376	451.44	164,775.6
2030	2,187	415.53	151,668.45

Source: Primary data, processed in 2025

Based on waste generation calculations, the amount of organic and inorganic waste generated in Watu-Watu Village in 2025 is estimated to be 628.90 tons/day and 229,548.5 tons/year. In 2030, these figures are projected to be 415.53 tons/day and 151,668.45 tons/year. The total projected population over a 5-year period is 2,187, . A comparison of waste generation in 2025 versus 2030 can be seen in Figure 1.

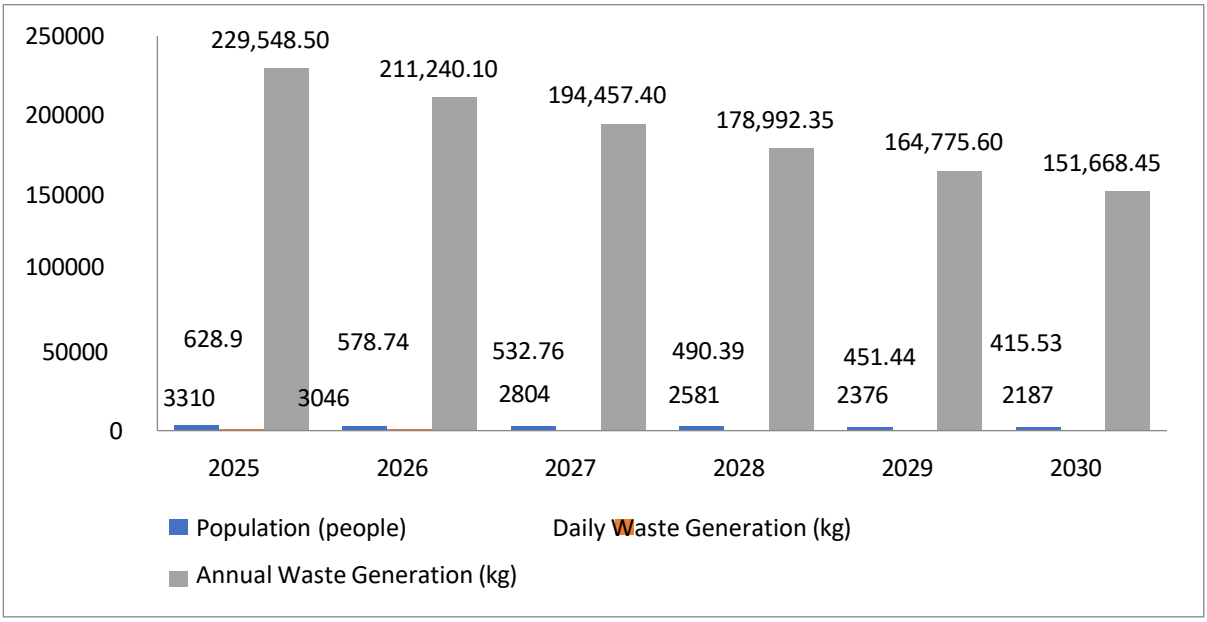


Figure 1. Projected Organic and Inorganic Waste Generation/Day and Per Year 2025–2030.

Waste Generation

The rate of waste generation is significantly influenced by several factors, such as household size, income, level of awareness, and willingness to sort waste. The higher the income and the larger the household, the greater the amount of waste generated. This is because higher income allows for more activities, which in turn results in more waste being generated (Thoyyibah and Warmadewanthi, 2023).

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There are various factors that influence waste generation. One of them is an individual's behavior regarding food waste—commonly referred to as food waste behavior—which is investigated from a consumer behavior perspective. Other factors can influence food waste behavior by indirectly affecting consumer behavior. These factors include material aspects within a household, such as living conditions and geographical access to transportation and stores, which influence the daily routines of food waste behavior within the household (Chaerul and Zatadini, 2020).

Research on waste generation rates in Watu-Watu Village provides important insights into consumption patterns and the management of organic and inorganic waste in the area. The data collected, as shown in Table 5.6, indicates that consumption patterns are dominated by inorganic waste amounting to (35.68 kg/day), (1,070.40 tons/month) and (390,696.00 tons/year) of inorganic waste, and (8,251 kg/day), (247.53 tons/month), and (90,348.45 tons/year) of organic waste, with a total average of (16,034,851 tons/year). This indicates a pattern where community consumption still relies on inorganic materials in daily life.

Waste generation refers to the amount of waste produced by the community in units of weight per capita per day. The results of waste generation measurements in Watu-Watu Village are expressed in units of weight. The total waste is accumulated, and then the daily amount and average are calculated. Next, the waste is sorted according to type. After sorting, the waste is weighed by type. After calculating the weight of waste generated per capita per day for each source, varying results were obtained for each source.

Table 1: Watu-Watu Subdistrict consists of 1,257 households with a total population of 3,596. There were 44 households in the initial sample, comprising 223 individuals. The weight of waste generated by these 44 households was 45 kg, providing an indication of waste weight per small household group. The daily waste weight per person is 0.19 kg, which is a key indicator for calculating waste projections. The total daily waste generation is 43,931 kg, representing the cumulative waste from the entire sample. The total annual waste generation reaches 16,034,851 tons. This is an annual projection based on daily data.

Based on Table 2, the waste composition in Watu-Watu Village is dominated by inorganic waste. This indicates that the majority of residents in Watu-Watu Village have a high propensity for consuming goods purchased from outside; specifically, young people or office workers tend to prefer buying ready-to-eat food, resulting in a higher volume of inorganic waste compared to organic waste.

The volume of inorganic waste generated in Watu-Watu Village indicates a waste of natural resources and increased environmental pollution. The high volume of inorganic waste,

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such as food packaging and beverage bottles, points to excessive consumption of single-use items and a lack of public awareness in applying the 3R principles (*reduce, reuse, recycle*). Uncontrolled disposal of inorganic waste can contaminate soil, water, and air, affecting the quality of life for the community and the surrounding ecosystem. Therefore, efforts are needed to raise public awareness, implement effective recycling programs, and establish policies that support the reduction of single-use items in Watu-Watu Village.

Projection Calculations for Organic and Inorganic Waste Generation in Watu-Watu Subdistrict for 2025–2030

Population projections are an important step in estimating waste generation from year to year, but they are not the only factor. Comprehensive data integration and consideration of other factors will yield more accurate waste generation estimates and support waste management planning.

Table 3 shows that the population projection for Watu-Watu Subdistrict for the 2025–2030 period indicates a continuous decline in population (Kendari City BPS, 2024). This may be attributed to several factors, primarily natural factors such as high mortality rates and non-natural factors such as out-migration. Additionally, urbanization and socioeconomic conditions may also contribute to the decline in population.

Table 4 shows the projected generation of organic and inorganic waste in Watu-Watu Village from 2025 to 2030. Based on waste generation calculations, the daily organic and inorganic waste generated in Watu-Watu Village in 2025 is estimated at 628.90 tons/day and 229,548.5 tons/year. In 2030, this will amount to 415.53 tons/day and 151,668.45 tons/year. The total projected population over the 5-year period is 2,187 people.

Residents of Watu-Watu Village do not have private waste collection sites to dispose of their household waste daily. The household waste generated daily by residents is collected in plastic bags and disposed of on vacant land; in fact, some residents still prefer to burn their waste rather than dispose of it at the TPS. The distance to the temporary waste collection site, which is quite far from residents' homes, is one of the factors causing residents to dispose of their waste directly at the TPS.

Waste management in Watu-Watu Village is still not optimal. Most respondents (72.73%) dispose of their waste without sorting it first, while a small portion (22.73%) burn their own waste. Only a small portion (4.55%) sort their waste before disposing of it at the waste collection point. The distance of the temporary waste collection site from residents' homes is also a factor contributing to low resident participation in disposing of waste at the waste

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collection point.

CONCLUSION

Conclusion

The conclusions of this study are as follows:

1. Analysis of waste generation in Watu-Watu Village shows an average household waste generation of 0.19 kg/person/day. The waste composition is dominated by inorganic waste (0.16 kg/day), which is higher than organic waste (0.037 kg/day). The total combined organic and inorganic waste generation reaches 45 kg/day
2. The projected waste generation in Watu-Watu Village for the year 2030 is 415.53 tons/day and 151,668.45 kg/year. This projection is based on population projections indicating an annual decline from 2025 to 2030, with a population of 2,187 people in 2030.

Recommendation

The recommendations that can be provided based on this study are as follows:

1. Community

The community needs to understand the importance of sorting organic and inorganic waste to facilitate the processing and recycling process, and to use environmentally friendly products, which can reduce the volume of organic waste disposed of while simultaneously producing beneficial organic fertilizer.

2. Government

The government needs to play an active role in planning and monitoring regulations related to waste management, as well as taking firm action in the event of violations that affect the public interest. Investment in adequate waste management infrastructure is crucial, including the establishment of more temporary waste collection sites (TPS) strategically distributed particularly those located closer to residential areas.

3. Environmental Science Students

For students, this research can enhance understanding of the importance of proper waste management and its impact on the environment. Additionally, this study can serve as a reference for future researchers. Evaluating the effectiveness of waste management programs currently being implemented in Watu-Watu Village will enable improvements and enhancements to these programs.

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