

Analysis of Socio-Economic Influences on Household Waste Management in West Sumatra

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Abstract: The purpose of this study was to determine the effect of education, population, and technology on household waste management decisions. This study used multiple linear regression analysis with data obtained from BPS Susenas 2023 data in the West Sumatra region. The findings of this study revealed that the level of education (junior high school, high school, and university), population, and technology, did not have a significant influence on household waste management decisions. Although some variables such as technology and education level have a positive relationship direction towards waste management, the results are not statistically significant, which means they are not strong enough to influence households' decision to manage waste. These results suggest that households' decision to manage waste does not only depend on education, population, or technology use, but may also be influenced by other factors, such as environmental socialization, local policies, availability of waste management facilities, and ingrained habits.

Keywords: Education; Household waste; Population; Technology; Waste management

Introduction

The environment is essential for the survival of humans and other organisms on earth. Pollution and environmental degradation continue to increase due to human activities, having a major impact on the health and survival of humans and other creatures. Environmental problems are close to human life. In developing countries, including Indonesia, urban waste is a problem that makes waste disposal that relies heavily on landfill unsustainable (Yanqoritha, 2023). Waste is a crucial issue in people's lives because it has a direct impact on the environment and the health of the population. Waste is a very serious problem that must be addressed. Waste has now become a very interesting issue because it is categorized as a national problem. Waste problems are closely related to daily life starting from population growth, economic growth, education, and changes in people's consumption patterns. Household waste is the most generated waste, causing

the main problem of waste accumulation in every residential area. The impact of this accumulation of household waste will pose a threat to the quality of the environment and human life. The first step to follow up on the threat caused by the accumulation of human household waste is to carry out the process of managing or utilizing household waste (Taufiqurrohman & Yusuf, 2022).

Waste management is an important process in the environmental management system. Waste management includes the disposal of waste in the containers provided, collection, transfer, and transportation of waste, as well as the waste processing for the final disposal process (Fadlilla et al., 2023). The increase in the volume of household waste every year refers to routine household waste management activities (Ratya & Herumurti, 2017). Waste management is very important to be carried out as soon as possible and with concept that is planned, so that this waste management can be carried out in a to be sustainable forever. Because

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waste is produced by humans every day to meet the needs of his life. If the public can know the substances that form waste, it is easy to manage waste to be reused for human needs and can be prevented as soon as possible so as not to interfere with human health (Hayana, 2015). The waste management approach is planned for a practical and effective waste management system that aims to build a sustainability effect for the community by applying the 4R principle (reduce, reuse, recycle, replace). The existence of these activities will improve the household waste management system and can foster a sense of concern for the environment (Astera & Herdiansyah, 2022). Various parties argue that the waste problem that occurs in Indonesia is something that must be addressed properly. People's littering behavior is determined by the socio-economic situation of the community and the lack of environmental awareness. Research results from several regions suggest that waste problems arise due to population growth, lifestyle changes, education, increasing community living standards and increasing the volume of waste used so that proper waste management is needed (Dwivedy & Mittal, 2013; Mahyudin, 2017).

Improper waste management will cause many negative impacts that will harm humans (Oluwagbayide et al., 2024). Waste must be managed properly so as not to cause environmental degradation, disease and others (Abubakar et al., 2022). In addition, household behavior that leads to an increase in the volume of waste will affect how the management is carried out by the household itself. West Sumatra is one of the provinces where household behavior in waste management tends to be low due to the lack of knowledge of the need for waste segregation. West Sumatra is currently experiencing rapid development characterized by increasing population and increasing household expenditure every year. There are several factors that cause households not to sort waste, namely: education, population, and technological knowledge to manage waste (Dores, 2015; Hafiza & Wahdi, 2024).

According to Law Number 18 of 2008 concerning Home Waste Management, every individual in the management of household waste and similar waste is required to reduce and manage waste in an environmentally sound manner. Waste reduction includes activities to limit waste generation, recycle waste, and reuse waste. Waste handling involves segregation, collection to TPS, transportation to TPA, processing, and final processing of waste (Law No. 18, 2008). Waste management activities are necessary because the population continues to grow and people's consumption patterns increase. Depending only on landfills (TPA), which have limited capacity.

Small-scale waste management tends to be done by stockpiling and burning, while large-scale involves various waste disposal sites (TPS) and landfills. The limitations of TPS can encourage people to dispose of waste in prohibited places such as rivers or lakes, and even burn it. Burning can pollute the air and cause health problems, while official waste disposal requires a consistent location. Another problem will arise when landfills are no longer able to accommodate the waste. As for in Indonesia, there is no government regulation regarding the food waste prevention. There is no strict regulation for household to handle their waste properly. A simple thing to do that can be implemented by every household is to separate the organic and non-organic waste, so it does not just mix up, and ends up in a landfill area (TPA). Though, organic and non-organic waste can be reused with proper processing (Gerda et al., 2023). Determining and moving the location of the landfill often causes problems with the surrounding communities as their environment is polluted by the waste and its negative effects (Saputra et al., 2020).

In Liberia households in carrying out waste management prefer to sort their own waste (Almazán-Casali et al., 2019). The results of his research that in Indonesia shows that there is a relationship between the unprofitable behavior of waste management and the socio-economic conditions of the region. The better the socio-economic conditions of a region, the better the behavior of concern for waste management will be (Safitri, 2017). Poor waste management also impacts social and economic aspects. Some of these include increased healthcare costs due to the emergence of diseases, unclean environmental conditions resulting from poor waste management, material losses due to damage to household items caused by floods, and so on. Ultimately, this will affect the social and economic life of the community as a whole. There are additional expenses for medical costs, buying new household items, and the discomfort in the environment due to the smell of garbage. Littered waste also depicts a slum and dirty environment, resulting in a decrease in asset value in the area (Saputro et al., 2016; Zairinayati et al., 2020).

Beni et al. (2014) the results of his research explain that age and gender have no effect on waste management behavior while education level and employment status have a significant effect on waste management behavior. Waste management behavior by means of 4R (reduce, reuse, recycle, replace) in some countries is very implementing these methods, especially in Belgium, Austria, and Germany. Economic development has a significant effect on waste generation. The richer a country is, the more waste it generates (Minelgaité & Liobikienė, 2019). The results of his research explain that there is a negative relationship

between income and waste management behavior. Households with high income will produce less waste than households with low income. In addition, education has no effect on waste management behavior (Thoyyibah & Warmadewanthi, 2023).

Method

This research method uses secondary data obtained from the Central Bureau of Statistics (BPS). The data used are data on education, population, and technology that affect the mindset in household waste management in 2023. The data that has been collected is then processed and analyzed using SPSS (Statistical Package for the Social Sciences) software. To analyze the relationship between the independent and dependent variables, this study uses multiple regression analysis. This technique was chosen because it is able to measure the effect of several independent variables on one dependent variable simultaneously. The regression equation used in this study is as follows (Satrya et al., 2023).

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \dots + e \tag{1}$$

Description:

Y : Consumer Satisfaction

α : Constant

β : Regression coefficient of independent variables

X1 : Variable Independent

X2 : Variable Independent

e : Error

Where Y is the dependent variable, X₁, X₂, ... is the independent variable, α is the constant, β₁, β₂, ... is the regression coefficient, and e is the error term. Interpretation of regression results is based on the R² value, significance p-value, and regression coefficients to determine the extent to which the independent variables affect the dependent variable. If necessary, data transformation or additional testing was performed to improve the validity of the result.

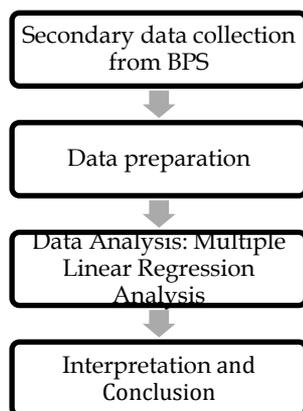


Figure 1. Flowchart of research methods

Result and Discussion

Multiple Linear Regression Analysis Results

Multiple Linear Regression Analysis is a statistical method used to analyze the relationship between one dependent variable (Y) and two or more independent variables (X₁, X₂, X₃, ...). This model is used to see the extent to which the independent variable can affect the dependent variable (Nurani et al., 2023). From the results of this study, it can be determined the influence of education, population and technological development on household waste management decisions in West Sumatra. The following table shows the results of multiple linear regression analysis in this study:

Table 1. The results of analyzing several variables on household waste management decisions

Variabel	B	Std. Error	Beta	t	Sig.
(Constant)	1.643	1.054		1.560	0.143
SMP (X1)	-0.048	0.049	-0.453	-0.981	0.344
SMA (X2)	0.005	0.026	0.134	0.173	0.866
College (X3)	-0.032	0.042	-0.674	-0.758	0.462
Total population (X4)	0.000	0.000	-0.144	-0.368	0.719
Technology (X5)	0.010	0.013	0.435	0.710	0.490

Source: Results of processed data, SPSS (2024)

$$Y = 1.643 - 0.048X_1 + 0.005X_2 - 0.032X_3 + 0X_4 + 0.010X_5 \tag{2}$$

The equation above shows that the intercept value is 1.643, meaning Y = 1.643.

The regression coefficient (B) for the SMP variable is -0.048, which means that there is a negative relationship between junior high school education and household waste management. This indicates that an increase in junior high school tends to decrease the value of household waste management, although this relationship is not statistically significant (p = 0.344). The t-value of -0.981 indicates the weak strength of the relationship. The regression coefficient of 0.005 indicates a very weak positive relationship between high school education and household waste management. Although the direction of the coefficient is positive, meaning that an increase in senior high school education slightly increases household waste management, this result is not significant (p = 0.866). This indicates that high school education does not have a significant influence on household waste management. The College variable has a coefficient of - 0.032, indicating a negative relationship between College education level and household waste management. With a p value of 0.462, this relationship is also not significant. This means that the College

education level does not have a significant influence on household waste management.

From the results above, education plays an important role in raising public awareness about the importance of responsible waste management. It is important to state that environmental awareness not only includes an understanding of the importance of keeping the environment clean, but also involves an awareness of the negative impacts of the effects of sustainable waste management (Pangesti et al., 2024). Effective waste management will reduce negative impacts on health and the environment. Meanwhile, unsustainable waste management practices, exacerbated by rapid urbanization and financial and institutional limitations, are detrimental to public health and environmental sustainability (Muliarta, 2024).

The coefficient for the Total Population variable is 0.000 with a Beta value of -0.144 and $p = 0.719$, indicating that total population does not have a significant relationship with household waste management. This means that an increase in population is not strong enough to influence an increase or decrease in household waste management. However, according to Tamyiz et al. (2018), the increase in population greatly affects the increase in the volume of household waste due to the increasing amount of food consumption by the population. This increase in production rate is not parallel to the rate of population growth but also in line with the increasing consumption patterns of the community. On the other hand, the waste handling capacity of the community and local government is not optimal. Waste that is not managed properly will affect the environment and the health of the surrounding community. According to Sinaga et al. (2023), the low level of community participation in reducing waste needs to be encouraged to be responsible for waste generation. needs to be encouraged to be responsible for the waste produced. Encouragement or motivation can be given in the form of involving the community in solving waste management problems waste problems that exist in the community. Strategies to increase community participation in the community by conveying the results of research to the community regarding community participation in waste management.

The regression coefficient for the technology variable is 0.010, indicating a positive relationship between technology and household waste management. Although the direction of the relationship is positive, meaning the higher the application of technology will slightly improve household waste management, this result is also not statistically significant ($p = 0.490$). According to Ahdi (2023) Technology has an important

role in helping to preserve the environment, as it can increase people's knowledge of technology.

The Effect of Education on Household Waste Management Decisions

The results showed that the education variable did not have a significant influence on waste management decisions in West Sumatra. This means that households with any level of education have no influence on waste management decisions. No matter how high the education of the household if the household itself does not have full awareness to do waste management this has nothing to do with one's education. Education plays an important role in shaping awareness and behavior related to environmental management, including waste. Formal education at the junior high school, high school, and university levels can equip individuals with basic knowledge about the environment, awareness of the dangers of waste to health and ecosystems, and the ability to think critically in making decisions related to waste management (Liao & Li, 2019). However, in this result, the absence of a significant effect suggests that formal education level alone is not enough to influence household waste management decisions.

There are several factors that may explain this finding. Firstly, although formal education provides a general understanding, the specific topic of household waste management may not be covered in depth in the curriculum, thus not having a direct impact on individual behavior in managing waste (Rezeki et al., 2024). Second, decisions in household waste management are often influenced by habits, environmental mindset instilled in the family, access to waste management facilities, and local policy support, which may be more influential than formal education level (Cheng et al., 2022). The level of environmental knowledge is related to environmental practices carried out, the more knowledge about waste management, the individual will have a pro-environment attitude from littering. When individuals have environmental knowledge and practices, individuals have behavioral control to maintain cleanliness (Agustina et al., 2023). To encourage better waste management at the household level, it is important for the government and educational institutions to integrate practical and applicable environmental education at every level of education. Education on proper waste management, the benefits of recycling, and the impact of waste on the environment, if implemented early and sustainably, can play a more effective role in influencing households decision to play an active role in waste management (Rahim, 2020; Mulasari et al., 2014). The waste problem cannot be solved by one party alone, but requires synergy from all groups, including the elements of educational institutions. The role of educational institutions such as

schools is vital in providing education and understanding to students and teachers about proper waste management (Dhany & Yulianti, 2025). The results of the study show that formal education in schools and social activities, such as interaction between students. This activity will shape students to recycle and collect waste, providing insight into its positive impact (Damanik & Saliman, 2023).

Effect of Population on Household Waste Management Decision

The results of this study show that population does not contribute significantly to household waste management decisions. While a high population is often associated with an increase in the volume of household waste that requires more intensive management, in this result, population does not appear to have a strong correlation with waste management decisions. Several factors could explain this finding. First, people's awareness and behavior patterns in managing waste are often more influenced by other factors, such as environmental education, local policies, or available waste management infrastructure (Massoud et al., 2021). Secondly, with a large population, variations in educational background, environmental awareness, and access to waste management technology are also diverse, so not all residents show concern or active involvement in better waste management (Henao-Rodríguez et al., 2024).

Overall, these findings imply that an increase in population alone is not enough to drive improvements in household waste management. To achieve significant changes, a more comprehensive approach is needed, such as community education, improved access to waste management facilities, and strict implementation of waste management policies, so that the decision to manage household waste can be optimally facilitated (Taswin et al., 2023).

The Effect of Technology on Household Waste Management Decisions

The regression analysis results show that technology has a positive influence of technology on waste management decisions, this influence is not statistically significant. This means that statistically, the application of technology does not have a strong enough impact in determining household decisions to manage waste. Technology in household waste management includes various innovations such as composting tools, waste shredding machines, waste management applications, or digital waste collection systems. These technologies have the potential to simplify the management process, speed up processing time, and increase convenience for households in managing their daily waste. However, although technology can help,

the level of application of technology in household waste management may still be limited, both in terms of availability and in terms of people's awareness and ability to use it (Mahyudin, 2014).

This result suggests that technology alone is not enough to encourage households to make active decisions regarding waste management. This could be due to several factors, such as limited access to the technology, the relatively expensive cost of using the technology, or low technological literacy among the community. In addition, the application of technology in household waste management also requires government policy support and intensive socialization so that this technology can be utilized optimally (Kadang & Sinaga, 2021).

To increase the impact of technology in household waste management, steps that can be taken include providing more accessible technology facilities, subsidies or incentives for the use of waste management technology, as well as education and training for the community on the benefits and how to use technology in waste management. With these measures, it is expected that the application of technology can be more effective in influencing household decisions to manage their waste independently and sustainably (Sadinov & Rajabov, 2023; Santosa et al., 2023).

Conclusion

The conclusion of this study shows that the independent variables studied, namely education level (junior high school, high school, and university), population, and technology, do not have a significant influence on household waste management decisions. Although some variables such as technology and education level have a positive relationship direction towards waste management, the results are not statistically significant, which means they are not strong enough to influence households' decision to manage waste. These results suggest that households' decision to manage waste does not only depend on education, population, or technology use, but may also be influenced by other factors, such as environmental socialization, local policies, availability of waste management facilities, and ingrained habits. To increase participation in household waste management, a more comprehensive approach is needed, including more integrated environmental education programs at every level of education, provision of accessible waste management technology, and strong government policy support. These measures can help encourage more active and sustainable decisions in waste management at the household level.

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Author Contributions

A.F.: preparation of initial draft, results, discussion methodology, analysis, conclusion; A.F., A.R., I.D., and N.S. review, proofreading, and editing. All authors have read and approved the published version of the manuscript.

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Conflicts of Interest

The authors declare no conflict of interest.

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