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Exploring Community Perspectives on Household Waste Management in Dili: Insights from Lahane Oriental

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This study explores the relationship between the knowledge, attitudes, and behavior of the community in managing household waste in the Urban Village of Lahane Oriental, Dili. This study was motivated by the growing global and local challenges of waste management, particularly in urban areas where population growth exacerbates this issue. This research employed an analytical observational design with a cross-sectional approach, using questionnaires distributed to 96 respondents selected through simple random sampling. Data were analyzed using descriptive statistics and Pearson's correlation to assess the relationship between knowledge, attitudes, and behavior. The results showed that the majority of respondents (61.5%) had sufficient knowledge of waste management, while 62.5% demonstrated a positive attitude toward proper waste management. However, the community's waste management behavior did not fully meet the expected standards, despite generally positive attitudes and moderate knowledge. These findings indicate that, although knowledge and attitudes play an important role in influencing behavior, the lack of adequate infrastructure and institutional support remains a major obstacle to optimal waste management practices. It was concluded that further educational campaigns and improvements in waste management facilities are crucial for enhancing community engagement in sustainable waste management. The findings provide practical implications for local governments and policymakers in designing effective waste management interventions that consider both behavioral and structural factors.

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Public Interest Statement

Waste management significantly impacts the environment and public health, especially in rapidly urbanized areas. In Lahane Oriental, Dili, household waste management challenges mirror global community issues. This study examined how community knowledge, attitudes, and behaviors affect waste management. Insights from this research can guide policymakers and local governments in creating targeted interventions for sustainable waste management. Emphasizing educational campaigns and improving infrastructure can enhance community engagement in waste disposal and mitigate environmental harm. The findings of this study offer valuable guidance for developing effective strategies to address both the behavioral and structural aspects of waste management.

Introduction

Household waste management (HWM) has become a significant global challenge that affects human health, the environment, and sustainable development. As population growth and urbanization rapidly increase, particularly in developing countries, the volume of waste generated continues to rise without effective management systems. According to a World Bank report, global waste volumes are projected to increase by up to 70% by 2050 if immediate action is not taken to improve waste management systems (World Bank Group, 2019)

Inadequate waste management results in numerous negative effects, including air, water, and soil pollution, all of which directly affect human health. The open burning of waste, a common practice in developing countries, emits harmful gases such as carbon monoxide (CO) and fine particles, which not only worsen air pollution but also contribute to climate change and an increase in respiratory diseases (Ferronato & Torretta, 2019, p. 1060) . Additionally, water contamination from poorly managed waste can lead to the spread of diseases such as diarrhea and cholera in areas with poor sanitation and waste management systems (IntechOpen, 2021)

Environmental damage caused by poor waste management is also significant. Improperly handled plastic waste and hazardous chemicals contribute to marine pollution, threatening marine life and coastal ecosystems (Ferronato & Torretta, 2019, p. 1061). In many developing countries, open dumping remains the primary method of waste disposal, which not only increases the risk of environmental pollution, but also creates social issues for nearby communities.

Achieving a sustainable HWM requires a comprehensive approach. This approach should include raising public awareness of the importance of waste separation and recycling along with the development of a better waste management infrastructure. Additionally, policies that support sustainable waste management practices are crucial in reducing the negative impacts on health and the environment (Abubakar et al., 2022, p. 12717)

The Urban Village of Lahane Oriental, located in Dili, Timor-Leste, faces serious challenges in terms of managing household waste. Like many other areas in developing countries, this region has limited infrastructure and resources to support effective waste management systems. Household waste in Lahane Oriental is often not properly separated before disposal and open dumping remains a common practice throughout the area. Plastic waste, organic matter, and other hazardous materials are frequently mixed, creating both environmental and public health risks for the local population.

Based on data from the local Environmental Agency, approximately 60% of the waste generated in Dili is not properly managed, including that in the Urban Village of Lahane Oriental. Most waste is disposed of in open dumps or burned indiscriminately, leading to increased air pollution and soil contamination. In particular, plastic waste has become a major issue in this area because of the lack of adequate recycling facilities and low public awareness about the importance of waste separation. This situation has the potential to worsen marine pollution because much of the plastic waste is carried into waterways and eventually ends up in the ocean.

Moreover, the community's attitude towards waste management remains a significant barrier. The level of public knowledge regarding the harmful effects of improper waste management remains low. This is exacerbated by a lack of educational programs and environmental campaigns that could raise public awareness. Previous research has shown that positive attitudes and better knowledge of waste management can significantly increase public participation in waste sorting and recycling.

Local authorities have made efforts to improve the waste management system through various cleanliness programs; however, resource and infrastructure limitations remain the main challenges. In the **Urban Village of Lahane Oriental**, more needs to be done to raise public awareness and provide better waste management facilities so that this issue can be fully addressed.

Public knowledge, attitudes, and education play crucial roles in determining the success of household waste management. Adequate knowledge of the environmental and health impacts of improperly managed waste greatly influences people's behavior in sorting, collecting, and disposing of waste. Studies show that communities with better knowledge are more likely to actively practice waste sorting at the source, reduce the use of single-use plastics, and support recycling programmes.

Community attitude plays an important role in waste management. For instance, a positive attitude towards the environment can motivate individuals to engage in waste management activities, such as composting and recycling. Conversely, apathy or a lack of responsibility towards the environment often becomes a major barrier to implementing an effective waste management system (Madden et al., 1992, p. 8). In the Urban Village of Lahane Oriental, the community's attitude towards waste management still needs improvement, as many residents do not yet understand the importance of waste reduction, sorting, and recycling

In addition to knowledge and attitudes, education affects waste management practices. Both formal and informal education, including environmental campaigns and training related to waste management, can raise public awareness and provide the practical skills needed (Ulhasanah & Goto, 2018, p. 1257). Research shows that communities with better access to environmental education tend to be more engaged in responsible waste management activities than those that do not receive adequate information or training.

In the context of the Urban Village of Lahane Oriental, a low level of education and environmental awareness is one of the main obstacles to the success of waste management programs. By providing more intensive environmental education programs, communities can be equipped with the knowledge and attitudes needed to support sustainable

waste management. Further efforts are needed to integrate waste management education into school curricula and community-based campaigns.

Research on household waste management has extensively covered the aspects of public knowledge, attitudes, and participation in various contexts. Previous studies have shown that environmental knowledge and education play an important role in encouraging more environmentally friendly behavior (Strydom, 2018, p. 41). However, most of this research focuses on developed countries or urban areas with better access to resources and information, thus overlooking the specific context of developing countries or rural areas that have different characteristics in terms of resources and public education levels (Wilson et al., 2006).

Although research has been conducted in urban areas of developing countries, there is still a gap in understanding how public knowledge, attitudes, and education affect waste management in areas with limited infrastructure, such as the Urban Village of Lahane Oriental, Dili. Furthermore, the specific relationship between formal education and environmental attitudes towards waste management in this area has not been widely studied. This study aims to fill this gap by exploring the unique factors influencing waste management in this area and providing new contributions to the global literature on waste management in developing countries.

The purpose of this study is to analyze the relationship between public knowledge, attitudes, education levels, and household waste management practices in the Urban Village of Lahane Oriental, Dili. This research seeks to answer the question: "How do knowledge, attitudes, and education influence waste management practices in the local community?" We hope that the results of this study will provide deeper insights into the social factors affecting the effectiveness of waste management in this area and contribute to the development of more effective environmental education policies and programs (Kamaruddin et al., 2013, p. 326)

Literature Review

Maghfiroh et al. (2018) highlight the importance of community participation in household waste management, particularly through education programs. Their main objective was to assess the knowledge, attitudes, and behavior of housewives before and after receiving training, focusing on the differences between traditional and modern settlements in Pudak Payung Urban Village. The study utilized random sampling and data collection methods, including questionnaires, tests, interviews, and observations. The results showed that the training significantly improved housewives' knowledge, attitudes, and behavior regarding waste management. The T-test indicated a significant increase in all three variables following the educational intervention (Maghfiroh et al. 2018). 116)

While Maghfiroh's research centers on the differences in knowledge and behavior among housewives in traditional versus modern settlements post-training, my study focuses on the relationship between community knowledge, attitudes, and education more broadly, specifically regarding waste management in Lahane Oriental Urban Village, Dili. My research not only examines changes caused by educational interventions, but also explores how both formal and informal community education impacts waste management practices. The emphasis on the local context in an area with limited infrastructure makes this study particularly relevant for identifying challenges in regions lacking adequate facilities and education. Additionally, my research expands the scope by utilizing the Theory of Planned Behavior framework to connect knowledge and attitudes with real actions related to waste management

Srisantyorini dan Ningtyas (2018) in the vicinity of the railway tracks in Jombang Urban Village, Ciputat District, South Tangerang City, demonstrate that community knowledge, attitudes, and behavior, especially among housewives, play a critical role in waste management (Srisantyorini & Kusumaningtias, 2018, p. 66) Their quantitative, cross-sectional study employed simple random sampling. The findings revealed that the majority of respondents had good knowledge of waste management (62.2%) and a positive attitude (61.0%), although only 53.4% demonstrated good waste management behavior. Statistical analysis indicated that factors such as income, attitudes, and regulatory support were significantly related to waste management behavior. This underscores the importance of regulatory support and education to encourage better waste management practices.

Srisantyorini and Ningtyas (2018) focused on the influence of socioeconomic factors, such as knowledge, attitudes, and regulatory support, on waste management behavior in urban areas, with a special focus on housewives. Meanwhile, my research focuses more broadly on the relationship between community knowledge, attitudes, and education regarding waste management in the Lahane Oriental Urban Village, Dili, paying special attention to the local context and infrastructure limitations in the region. My study also explored the role of formal and informal education in shaping waste management behavior, a topic not extensively covered in their study. Additionally, I integrate the Theory framework to better understand the relationship between attitudes and real behaviors related to waste management.

Bakhtiar, Ginting, and Silitonga (2022), in Meunasah Alue Ie Puteh Village, North Aceh, emphasized the importance of community behavior in waste management. Their study revealed that knowledge, attitudes, income, and availability of facilities significantly influence household waste management behavior, with community knowledge being the most

dominant factor affecting behavior, with a significance value of 0.000 (Bakhtiar et al., 2022, p. 86). This suggests that the higher the community's knowledge level, the better they manage household waste.

This differs from previous findings that show that education can drive changes in waste management behavior in other regions. These results highlight the need for more community-based and specific educational strategies to improve the effectiveness of waste management in North Aceh. One suggested initiative is the development of waste banks, which help communities sort waste based on its economic value, as proposed by Bakhtiar.

The main difference between Bakhtiar's study and mine lies in the research context and educational approaches applied. Bakhtiar's research focuses on rural communities in North Aceh, while my study was conducted in Lahane Oriental Urban Village, Dili, considering the region's infrastructure limitations. Additionally, Bakhtiar's research emphasizes the role of community knowledge and attitudes in waste management through the waste bank approach, while my study focuses on the relationship between community knowledge, attitudes, and education, including both formal and informal education, in enhancing waste management practices. I also employ the Theory framework to gain a deeper understanding of how knowledge and attitudes influence real behaviors in waste management, providing a stronger theoretical approach to understanding community behavior dynamics related to waste management.

Rahman (2020), explains that one of the main factors in waste management is active community participation. This study focuses on the fishing village of Untia, Makassar City, where the community's knowledge and attitudes significantly influence their participation in waste management. The results showed that 82% of the respondents had low participation in waste management, which was associated with a lack of knowledge and negative attitudes towards the importance of waste management (Rahman et al., 2020).

This study suggests that educational and outreach programs led by the government, healthcare workers, and community leaders are required to raise awareness and community participation. Moreover, this study found that other factors, such as the availability of facilities and infrastructure, play an important role in the success of waste management. It emphasizes the importance of collaboration between the government and the community to achieve a more effective waste management system in urban and coastal areas.

The main difference between Rahman's research and ours lies in its geographical focus and the aspect of community participation being studied. Rahman et al.'s study focuses on the fishing community in Untia village, with particular attention to community knowledge and attitudes towards waste management in a coastal environment. My research focuses on the relationship between knowledge, attitudes, and education in household waste management in the Lahane Oriental Urban Village, Dili, involving a different local context and infrastructure challenges. Additionally, my study utilizes the Theory framework to explore how community knowledge and attitudes can be translated into real behaviors in waste management, offering a deeper theoretical approach to understanding community behavior dynamics.

Materials and Methods

This was an observational analytical study with a cross-sectional design. The aim of this design is to explore the relationship between the variables of community knowledge, attitudes, and education regarding household waste management (HWM) in the Urban Village of Lahane Oriental, Dili, at a specific point in time. Cross-sectional studies are commonly used to observe the prevalence or correlation between variables at a single point without any intervention or changes in the variables (Wang & Cheng, 2020). The sampling technique used in this study was simple random sampling, where every member of the population had an equal chance of being selected as a sample (Gable, 1994). Data were collected through a specially designed questionnaire to quantitatively measure the variables of knowledge, attitudes, and behavior related to household waste management. The use of a cross-sectional design in this study allowed the researcher to identify patterns or trends without direct intervention, making it effective for depicting a situation at a specific time.

The population in this study consisted of all residents of Lahane Oriental Urban Village, with a total of 159 families. The sample size was 96 families, which was calculated using the standard population deviation formula. Accidental sampling was employed, where available respondents were selected during the research, provided they met the established inclusion and exclusion criteria. Sample selection was conducted using a simple random sampling methodology, which affords each member of the population an equal probability of selection. However, it is important to note that, while the sample size is generally deemed sufficient for descriptive research, a more comprehensive justification of sample representativeness is warranted. To address this concern, social research guidelines (Krejcie, 1970) suggest that sample sizes for smaller populations can meet validity criteria if the distribution of key demographic characteristics, such as age, gender, and educational attainment, is taken into account. Applying this principle to the current study, while this initial assessment provides a foundation for the research, although a sample size of 96 is considered reasonably appropriate for the local population, further analysis of the sample distribution would contribute to minimizing potential bias in the research findings.

The data in this study were collected using a questionnaire as a primary tool. The questionnaire consisted of closed-ended questions designed to measure knowledge, attitudes, and behavior related to household waste management. The questionnaire method was chosen because it is efficient in collecting data from a large number of respondents in a relatively short time (Brace, 2018). The validity of the measuring instrument was tested through content validity, in which the questionnaire was evaluated by experts in waste management and research methods to ensure the relevance and connection of each item to the variables being measured (Azen & Walker, 2021, p. 356). The reliability of the questionnaire was tested using internal reliability tests such as Cronbach's alpha, which is used to measure the internal consistency of the questionnaire items. A Cronbach's Alpha value of greater than 0.7 is considered to indicate good reliability (Christmann & Van Aelst, 2006, p. 1661).

The data obtained from the questionnaire were analyzed using descriptive and inferential statistics. To analyze the relationship between community knowledge, attitudes, and education on waste management behavior, a chi-square test or logistic regression was used for the categorical variables. Additionally, a T-test was used to examine the mean differences between groups. Data processing was conducted using the latest version of (Statistical Package for the Social Sciences), which allows for more complex and accurate data analysis. These analytical techniques were chosen because of their ability to identify patterns of relationships between variables and produce valid results.

Results

This chapter presents the results of the research conducted based on data collected from respondents in the Urban Village of Lahane Oriental, Dili. These results include a general overview of the respondents' characteristics as well as an analysis of the relationship between the variables of knowledge, attitudes, and community behavior in managing household waste (HWM). Data analysis was conducted to explore how these factors contribute to the community's efforts to improve waste management. Additionally, this chapter includes the results of the validity tests of the instruments used to measure these variables, ensuring the reliability of the research findings.

4.1 Respondent Characteristics by Gender

The gender distribution of respondents in this study conducted in the **Urban Village of Lahane Oriental**, Dili, is presented in the table below.

Table 1 Frequency Respondent Characteristic by Gender

Gender	Number of Respondents	Percentage (%)
Men	24	25.0
Women	72	75.0
Total	96	100.0

Source: Data processed by the author

Table 1 shows that of the 96 respondents involved in this study, the majority were women, with a total of 72 individuals (75.0%). Meanwhile, the number of men who participated as respondents was 24 individuals (25.0%). This indicates that women were dominant in the sampling process, which may be attributed to their higher participation in household management activities and their role in waste management within the family environment. This distribution also demonstrates a significant gender representation, ensuring that the study's findings reflect perspectives of both genders.

4.2 Respondent Characteristics by Age

The age distribution of the respondents involved in the study conducted in the Urban Village of Lahane Oriental, Dili, is presented in the following table:

Table 2 Frequency Respondent Characteristic by Age

Age Category	Number of Respondents	Percentage (%)
<35	53	55.2%
35-44	20	20.8%
45-54	13	13.5%
55-64	10	10.4%
Total	96	100.0%

Source: Data processed by the author

As shown in Table 2, the majority of respondents were under 35 years old, totaling 53 individuals (55.2%). This age group was the most involved in the study, highlighting the dominance of the productive age group in waste management participation. Respondents aged 35-44 years amounted to 20 individuals (20.8%), followed by 13 respondents (13.5%) aged 45-54 years, The least represented group was–55-64 years old, with 10 individuals (10.4%).

This distribution indicates that most respondents belong to younger and productive age groups, who may be more active in environmental activities and waste management. These age groups tended to be more responsive to changes and innovations in waste management. Nevertheless, participation from older age groups also provides important insights into the experience and behavior of household waste management.

4.3 Distribution of Respondent Knowledge Frequency

The distribution of respondent knowledge levels related to waste management in the Urban Village of Lahane Oriental, Dili, is shown in the following table:

Table 3 Frequency Respondent Knowledge Frequency

Level of Knowledge	Number of Respondents	Percentage (%)
Enough	59	61.5%
Good	37	38.5%
Total	96	100.0%

Source: Data processed by the author

Table 3 Of the 96 respondents, the majority demonstrated adequate knowledge of waste management. Meanwhile, 37 respondents (38.5%) had a good knowledge of waste management.

These results indicate that most respondents in the Lahane Oriental Urban Village have a moderate understanding of waste management, although there remains room for improvement. Having a solid understanding of waste management is crucial for encouraging more responsible behavior in handling household waste. However, with over half of the respondents still at the "adequate" level of knowledge, additional outreach and educational programs may be necessary to enhance the community's overall understanding.

The fact that the majority of respondents possessed only an adequate level of knowledge, with a smaller portion showing good knowledge, highlights the need to strengthen efforts aimed at improving community awareness and knowledge about waste management. This would ensure that all community members were optimally equipped to engage in better waste management practices.

4.4 Distribution of Respondent Attitudes Frequency

The distribution of respondent attitudes regarding household waste management in the Urban Village of Lahane Oriental, Dili, is shown in the following table:

Table 4 Frequency Respondent Attitudes Frequency

Tingkat Pengetahuan	Number of Respondents	Percentage (%)
Enough	59	61.5%
Good	37	38.5%
Total	96	100.0%

Source: Data processed by the author

As shown in Table 4, the majority of respondents had adequate knowledge of waste management, with 59 individuals (61.5%), while 37 individuals (38.5%) had good knowledge. None of the respondents had a low level of knowledge. These results suggest that most of the population in the Lahane Oriental Urban Village possesses an adequate understanding of waste management. This indicates that they have a basic understanding of the importance of managing waste; however, there is still room for improvement in educational efforts so that more individuals can attain a higher level of knowledge. Improving knowledge is expected to encourage communities to adopt more effective and environmentally friendly waste management practices. More intensive education and outreach programs are necessary to strengthen the community's understanding of proper waste management.

4.5 Distribution of Respondent Attitudes Frequency

The distribution of respondent attitudes toward household waste management in the Urban Village of Lahane Oriental, Dili, is presented in the following table

Table 5 Frequency Respondent Knowledge Frequency

Sikap	Number of Respondents	Percentage (%)
Negatif	36	37.5%
Positif	60	62.5%
Total	96	100.0%

Source: Data processed by the author

Based on Table 5, out of a total of 96 respondents, 60 (62.5%) demonstrated a positive attitude toward waste management, while 36 (37.5%) had a negative attitude. This indicates that the majority of the population in the Lahane Oriental Urban Village has a positive outlook on waste management.

From these data, it can be concluded that the attitude of the community in the Lahane Oriental Urban Village tends to be positive, with more than half of the respondents showing concern and awareness of the importance of proper waste management. However, approximately one-third of the respondents had negative attitudes, highlighting the need for further efforts to improve public awareness and attitudes through more intensive environmental education and campaigns.

4.6 Distribution of Waste Management Behavior Frequency

In this study, community behavior toward waste management was analyzed using Pearson's correlation to examine the relationship between respondents' statements and their waste management behavior. The following table presents the distribution of waste management behavior among respondents in relation to household waste management.

Table 6 Frequency Distribution of Waste Management Behavior Frequency

Sikap	Number of Respondents	Percentage (%)
Negative	36	37.5%
Positive	60	62.5%
Total	96	100.0%

Source: Data processed by the author

Based on the Pearson correlation analysis (Table 6), all statements related to waste management behavior showed a significant positive relationship. The correlation values ranged from 0.425 to 0.530, with a significance level of 0.000, indicating that the better the community's knowledge and attitudes, the better their behavior in waste management. The highest correlation was found for statement X1.10, with a correlation value of 0.530, which demonstrates a strong relationship between knowledge, attitudes, and actual waste management practices.

Overall, these results suggest that waste management behavior in the Urban Village of Lahane Oriental is influenced by community knowledge and attitudes. Respondents with better knowledge and positive attitudes tended to exhibit more proactive behavior in properly managing waste, such as separating organic and non-organic waste and supporting local environmental programs. This reinforces the importance of educational interventions and environmental campaigns focused on increasing public knowledge, as these have proven effective in shaping better waste management behavior.

The results from the Pearson Correlation table show that all statements related to waste management behavior have significant correlations, with Pearson correlation values ranging from 0.425 to 0.530 (all values have a significance level of 0.000). This significant positive correlation indicates that the better the community's knowledge and attitudes, the better their behavior in waste management.

Good waste management behavior, such as separating organic and non-organic waste, disposing waste in the appropriate place, and supporting recycling programs, is influenced by the community's level of knowledge and positive attitudes. Thus, these findings indicate a close relationship between knowledge, attitudes, and community behavior toward waste management, where improvements in knowledge and positive attitudes tend to lead to better waste management behavior in households in the Lahane Oriental Urban Village.

Discussion

The findings of this study reveal that the knowledge, attitudes, and behavior of the community in managing household waste in the Urban Village of Lahane Oriental generally falls into the categories of adequate to good. These results support the concept outlined in the Theory of Planned Behavior introduced by Ajzen, which posits that positive knowledge and attitudes play a crucial role in forming intentions for good behavior. In this study's context, the higher the community's knowledge of the impact of waste and how to manage it, the more positive their attitude toward waste management, which in turn encourages better behavior in handling household waste The findings of this study reveal that the knowledge, attitudes, and behavior of the community in managing household waste in the Urban Village of Lahane Oriental generally falls into the categories of adequate to good. These results support the concept outlined in the Theory of Planned Behavior introduced by Ajzen, which posits that positive knowledge and attitudes play a crucial role in forming intentions for good behavior. In this study's context, the higher the community's knowledge of the impact of waste and how to manage it, the more positive their attitude toward waste management, which in turn encourages better behavior in handling household waste (Ajzen, 2020). 315)

Most of the respondents had adequate knowledge of waste management. This is consistent with the research of Hopper and Nielsen, who found that even when adequate knowledge exists, pro-environmental behavior is often hindered by other factors, such as a lack of facilities or regulations to support comprehensive behavior change. In

Lahane Oriental Urban Village, while the community's knowledge is fairly good, the lack of adequate waste management facilities has become a barrier to better waste management behavior (Hopper & Nielsen, 1991, p. 196)

The community's attitudes toward waste management in this study also tended to be positive. This aligns with Schwartz's theory, which emphasizes that positive attitudes toward the environment, such as concerns about the impact of waste, can increase participation in environmental management activities. In this study, most respondents showed a positive attitude toward waste sorting and management, indicating that awareness of the importance of environmental preservation has begun to form (Schwartz, 1977). 222).

However, the community's waste management behavior has not reached the expected level, similar to the findings of Diekmann and Preisendörfer, who suggested that although positive attitudes toward the environment exist, other factors, such as social norms and easy access to environmental facilities, play a crucial role in promoting eco-friendly behavior. Therefore, a more comprehensive approach, including improving waste management facilities and ongoing socialization efforts, is needed to ensure that the community not only holds positive attitudes and knowledge, but also actively engages in better waste management practices in their environment (Diekmann and Preisendörfer, 1998, p. 80)

5.1 Community Knowledge in Waste Management

The results indicate that the majority of respondents in Lahane Oriental Urban Village have adequate knowledge regarding waste management. Several factors influence this level of knowledge, including education, access to information, and daily experience in handling waste. Education plays a key role in shaping people's understanding of the negative impact of waste on the environment and health. As Asmawati et al. stated, environmental education is essential for raising public awareness of the importance of good waste management, especially in urban areas (Desa et al., 2012). 48)

Access to information is another factor affecting community knowledge. People who are more frequently exposed to information through campaigns, mass media, and outreach programs tend to have a better knowledge of waste management. Media campaigns on recycling and waste sorting have been found to significantly increased public knowledge and participation in waste management.

Good knowledge has a significant impact on waste management behavior. Afroz stated that more knowledge often translates into better actions in waste management, such as sorting waste, recycling, and reducing the use of plastics. However, in this study, although the community's knowledge was quite good, their waste management behavior was not optimal. This suggests that, while knowledge is an important factor, other factors such as the availability of facilities, policy support, and social norms also influence overall waste management behavior (Afroz et al., 2009).

Thus, while the community in the Lahane Oriental Urban Village possesses adequate knowledge about waste management, additional interventions, such as improving infrastructure and ongoing campaigns, are needed to ensure that this knowledge can be fully translated into real actions for more effective household waste management.

5.3 Community Attitudes Toward Waste Management

The results show that community attitudes toward waste management in Lahane Oriental Urban Village tend to be positive, with more than half of the respondents (62.5%) demonstrating concern for the importance of proper waste management. However, a significant proportion of respondents (37.5%) expressed negative attitudes, indicating differing perceptions within the community regarding the urgency of effective waste management.

Positive attitudes toward waste management are often linked to environmental awareness, better knowledge, and access to waste management facilities. Respondents with positive attitudes were more likely to be aware of the harmful effects of poor waste management, such as environmental pollution and health issues. Hurst found that individuals with higher environmental awareness are more likely to engage in pro-environmental behaviors, including proper waste management. Access to information through education and outreach also contributes to positive attitudes (Hurst et al., 2013).

On the other hand, negative attitudes are usually influenced by lack of knowledge, limited facilities, and skepticism regarding environmental impact. Raco pointed out that a lack of understanding or experience of the environmental consequences of waste management can lead to apathetic attitudes. Respondents who perceive waste management as a low priority or who lack access to adequate facilities are more likely to show negative attitudes toward waste sorting and management (Raco, 2000, p. 577).

This disparity can be further explained by social and economic factors. People with a higher economic status tend to have more positive attitudes because they have access to more resources, including better information and waste management facilities. Meanwhile, people from lower economic backgrounds may feel that they lack time, resources, or access to facilities that support proper waste management. Environmental education must be enhanced, especially

for disadvantaged groups. In addition, improving waste management infrastructure and strong government policy support will play a critical role in shaping positive attitudes toward waste management.

Knowledge of waste management can be divided into two main categories: theoretical and practical. Theoretical knowledge refers to an understanding of fundamental principles or concepts, such as the environmental impact of poor waste management, the role of waste in pollution, and the importance of resource conservation (Dewulf et al., 2020, p. 5). This type of knowledge helps to raise awareness and motivates individuals to engage in responsible waste management practices. Meanwhile, practical knowledge refers to specific skills and actionable steps that can be directly applied, such as methods for separating organic and inorganic waste, recycling techniques, or composting practices (Latif et al., 2013, p. 867).

Practical knowledge has a more direct impact on waste management behavior as it enables individuals to take tangible and effective actions. Studies show that combining theoretical understanding with practical skills can foster better waste management behavior, as individuals not only understand the importance of waste management, but also have the capability to implement it (Gifford & Nilsson, 2014, p. 144).

Pro-environmental behavior in waste management includes activities such as sorting, recycling, and composting. These actions are essential for effective waste management, reduction of landfill waste volume, and minimization of negative environmental impacts (Kollmuss & Agyeman, 2002). For instance, waste sorting allows organic and inorganic materials to be processed differently, optimizing recycling and composting (Barr et al., 2005, p. 1430). Factors that encourage this behavior include environmental awareness, access to recycling facilities, and available information on proper waste management (Vicente & Reis, 2008, p. 140).

In contrast, barriers, such as inadequate facilities or limited time and effort, can diminish community motivation for pro-environmental behavior. With the support of accessible facilities and social support, good waste management behavior is more likely to be sustainably adopted by communities (Vining & Ebreo, 1992, p. 1580). Studies have also shown that campaigns that increase the understanding of the positive impacts of such behavior can overcome these barriers and promote long-term change.

Classifying concepts such as theoretical and practical knowledge, passive and proactive attitudes, and pro-environmental behavior helps to analyze research findings more deeply. Understanding these distinctions enables researchers to pinpoint specific areas that require improvement in environmental education and waste management campaigns. For example, theoretical knowledge aids in building awareness, but to encourage concrete actions, practical knowledge is more effective in demonstrating the specific steps that can be taken (Hines et al., 1987, p. 7)

Additionally, fostering proactive attitudes, not just passive ones, provenly enhances sustainable waste management actions as this attitude leads to stronger intrinsic motivation (Kaiser et al., 1999, p. 18). This category analysis also highlights that educational strategies focusing on practical actions and fostering proactive attitudes can have a more significant impact on overcoming behavioral barriers within communities (Blake, 1999). Therefore, this study underscores the importance of a more holistic, skill-based environmental education approach to drive long-term behavioral changes.

The main findings of this study indicate a significant gap between the community's level of knowledge and its actual behavior in household waste management in Lahane Village Oriental. Most respondents possessed moderate to high knowledge levels about waste separation and recycling, with survey results showing that approximately 61.5% of respondents had a basic understanding of the environmental impact of waste. However, the actual behavior, such as waste sorting, recycling, or composting, remains suboptimal. The data revealed that only a small portion of the respondents consistently practiced these actions in daily life.

This discrepancy suggests the presence of barriers such as a lack of supporting facilities or social and economic constraints that hinder the application of knowledge in practice. This phenomenon is also observed in research by Kollmuss and Agyeman, who assert that environmental knowledge and positive attitudes are often insufficient to drive behavioral change without supportive structural factors such as infrastructure and policy. Similarly, Hines indicates that even when individuals possess environmental awareness, external factors—such as access to recycling facilities and community support—significantly influence their likelihood of actively participating in waste management

The observed gap between knowledge and behavior in waste management suggests that further research is needed to understand the inhibiting factors influencing the translation of knowledge into action. Social factors, such as community norms and collective support, as well as economic and infrastructural constraints, such as additional costs or a lack of access to recycling facilities, often impact individuals' motivation to act according to their knowledge (McKenzie-Mohr, 2000, p. 531). For instance, McKenzie-Mohr found that community-based approaches that account for social norms can significantly increase participation in recycling programs.

In Lahane Village Oriental, these barriers may be the main reason why individuals with sufficient knowledge have not been motivated to fully adopt environmentally friendly behaviors. Understanding these factors will enable the design of more targeted interventions, such as providing economic incentives or improving facilities, to encourage substantial and sustainable behavioral change.

Social constraints are one of the factors influencing waste management behavior, even when the knowledge of correct practices is sufficient. A common social constraint is a lack of social norms or strong community support for collective waste management. Without this support, individuals often feel that their efforts in waste separation or recycling will not have a significant impact, resulting in a low motivation to participate in environmentally friendly practices (Schultz et al., 2007). Additionally, established norms and traditional habits can also act as barriers to behavioral change. For example, some communities still view littering or burning waste as a common practice, and changing these perceptions and practices requires a more in-depth educational approach (Farrow et al., 2017).

The absence of pro-environmental social norms within a community reduces the social pressure for individuals to behave according to their knowledge. This aligns with social norm theory, which posits that individual behavior is heavily influenced by the views or expectations of their social group. In environments with strong pro-environmental norms, individuals are more likely to engage in recycling or waste separation because they perceive it as a societal standard (Cialdini et al., 2003). Conversely, without supportive social norms or expectations, individuals may feel that their waste management efforts are underappreciated, ultimately hindering the implementation of correct behaviors (Lapinski and Rimal, 2005).

In addition to social norms, collective community support also plays an important role. Waste management participation tends to be lower in environments with minimal community support, as individuals may feel that their efforts lack broader impact. Studies have shown that collective support, such as the presence of community groups active in waste management, encourages greater involvement in environmentally friendly activities. This support may include local organizations promoting waste separation or regular events involving residents in environmental management activities. Therefore, social factors such as community norms and collective support must be considered in efforts to enhance pro-environmental behavior, as they play key roles in bridging the gap between knowledge and tangible actions.

Economic constraints often pose major challenges to effective waste management, especially among low-income households. Additional costs required for waste management practices, such as purchasing special bags or paying for transportation to recycling centers, can burden individuals or families with limited income (Barr et al., 2003). 410). This constraint reduces the motivation for environmentally friendly behavior, as people may prioritize other basic economic needs. In many developing countries, economic limitations are significant obstacles to recycling programs even when communities understand the importance of waste management.

Gifford and Comeau indicate that people with limited economic access have fewer options to participate in recycling or waste-sorting activities. These extra costs include not only necessary waste management materials, but also time and effort that could be directed toward other economic activities. Moreover, the economic burden borne by low-income households also makes them likely to choose simpler and cheaper solutions, even if these practices are less environmentally friendly, such as burning or indiscriminate waste disposal (Gifford & Nilsson, 2014, p. 144).

Infrastructure constraints pose significant challenges for the implementation of effective waste management. A primary issue is the limited access to adequate recycling facilities and waste collection centers. Many areas, particularly in developing regions such as Lahane Village Oriental, face limitations in waste management infrastructure, including a lack of facilities supporting separate waste collection and processing. This frequent lack of access becomes a barrier for people who intend to practice waste sorting. The findings indicate that most respondents reported difficulty in finding sorting and recycling facilities near their homes, despite understanding the importance of these practices.

This barrier aligns with Medina's findings, which suggest that areas with minimal waste management infrastructure face challenges when implementing effective recycling systems. When collection facilities are not widely available or are far from residential areas, people are more likely to engage in indiscriminate disposal or burning, which negatively affects the environment and public health. Additionally, a lack of infrastructure often results in high waste transport and processing costs, adding to the reasons that local governments may hesitate to allocate resources for waste management facility improvements (Medina, 2010).

Infrastructure limitations also impact pro-environmental behavior. According to Zeng, the availability of adequate facilities plays a crucial role in encouraging proactive waste management behavior (Al-Khatib et al., 2015). When infrastructure is supportive, individuals are more inclined to practice waste sorting owing to ease of access and affordability. However, in Lahane Village Oriental, limited facilities make it difficult to adopt these practices widely, even among those who already understand the importance of waste sorting.

5.6 New Approaches to Waste Management in Lahane Village Oriental

Lahane Village Oriental in Dili faces significant challenges in household waste management owing to population growth, limited facilities, and low community participation. As in many urban areas in developing countries, growth in waste volume often exceeds infrastructure capacity, posing risks to public health and the environment (Guerrero et al., 2013). 221). These challenges are compounded by limited waste management education programs, resulting in low awareness among residents regarding waste separation and recycling. Thus, innovative approaches, particularly digital technology-based ones, are relevant for implementation in this area.

Technology-based approaches, including educational applications and community engagement via digital platforms, have proven effective in various developing countries by enhancing collective waste management awareness and practices (Cheah et al., 2022, p. 113619). technoinformationoand compostingo informa andi andomposting waste sorting, compostiwasnd recycling, which were previously less familiar to residents. For example, mobile applications and social media campaigns have successfully raised public awareness of recycling in urban communities, driving significant behavioral changes in household waste management (Shan et al., 2020)

Digital technology enables active community involvement through features such as cleanliness reporting and environmental monitoring. In other areas, concepts such as digital waste banks have successfully increased community participation by providing economic incentives such as redeemable points, which motivate residents to sort and recycle their waste (Challcharoenwattana & Pharino, 2018, p. 4500). This concept not only reduces the volume of waste sent to landfills but also provides direct economic benefits to the community.

In Lahane Village Oriental, implementing digital technology for waste management can help address infrastructure and resource limitations by providing accessible information and instructions. This approach has the potential to drive better behavioral change, consistent with research showing that communities with access to digital education are more proactive in supporting sustainable environmental management practices. With the involvement of local governments and technology providers, this innovation can support more effective waste management in the future.

Digital education programs in waste management offer numerous benefits such as increasing community knowledge and awareness of effective and eco-friendly waste management practices. Mobile apps, social media, and other digital platforms allow information to be widely disseminated, making education more accessible to a broad audience, including in areas with limited infrastructure. In the context of waste management, digital education programs can provide content on sorting waste, recycling benefits, and environmental and health impacts of waste. This is reinforced by Titiana's study, which found that mobile-based applications strengthen environmental awareness in urban communities, boosting participation in waste management (Ertiö 2015).

Digital platforms also allow for interactive engagement through features, such as cleanliness violation reporting or tracking individual recycling habits. For instance, applications with reward or gamification features, providing points or prizes to users who routinely report recycling or waste separation practices, have been proven to encourage positive behavioral change. A study by Budihardjo shows that incentive-based approaches can increase community engagement in waste management programs by up to 40%, highlighting the program's effectiveness in promoting more responsible practices (Budihardjo et al., 2022, p. 102488).

Another benefit is easy access to real-time updated information, enabling residents to obtain relevant details, such as waste disposal locations or pickup schedules, which can be updated directly by local environmental managers (Nižetić et al., 2019). 566). This is especially useful in Lahane Village Oriental, where access to traditional information is often limited. Technology-based participation concepts in waste management, such as digital waste banks or reward systems via applications, encourage communities to be more active in supporting sustainable waste management. Digital waste banks provide platforms where residents can deposit sorted waste to earn points or credits exchangeable for goods or services, thus providing an economic incentive. Zhang's research suggests that technology-based incentives like this increase recycling participation by up to 30%, as people are more motivated by direct benefits (Zhang, 2019, p. 6707).

In addition to economic benefits, technology-based participation significantly reduces landfill waste volumes (Maiurova et al., 2022). With this application, residents can easily track recycling activities and receive guidance on effective waste separation methods. This reward system also increases environmental awareness, which is a key foundation for long-term behavioral changes. In Lahane Village Oriental, this concept is highly relevant because of limited waste management infrastructure. By leveraging technology, residents can be empowered to sort and manage their waste, thereby reducing the burden on local waste management facilities. Technology-based systems also allow local governments to monitor and assess the effectiveness of waste management programs in real time, thereby enabling sustainable and adaptive policy improvements.

An incentive program in the form of reward-based initiatives is an effective strategy for promoting active community involvement in household waste management. Rewards can include points or prizes for households that show high

commitment to waste separation and recycling. These incentives not only raise awareness but also create direct motivation, especially for low-income groups, who may see incentives as added value for their pro-environmental activities (Ando & Gosselin, 2005, p. 427). In practice, households can earn points redeemable for goods or daily needs based on the amount of waste they donate or recycle. A study in Japan, for instance, showed that point-based incentive programs increased community recycling participation by up to 30% more than in areas without incentives.

Furthermore, collaboration with local governments is crucial for the success of this incentive system. The local government can support the program by providing subsidies for the purchase of eco-friendly waste bags or free access to recycling centers. This support facilitates community involvement, particularly for those who may struggle financially to purchase necessary supplies or access recycling facilities. Experiences from several U.S. cities show that subsidy programs for recycling bags and reduced fees for waste management services have boosted community engagement in recycling programs (Kinnaman and Fullerton, 2002). 45). Through this collaboration, reward programs can become more integrated and sustainable with a broader impact on raising environmental awareness and reducing unmanaged waste.

Conclusion

This study shows that the knowledge, attitudes, and behavior of the community in Lahane Oriental Urban Village regarding household waste management are generally at an adequate to good level. Most communities have sufficient knowledge of waste management, but there is still room for further improvement, especially in translating this knowledge into more effective waste management practices. Community attitudes toward waste management tend to be positive, reflecting an awareness of the importance of environmental conservation. However, actual behavior in managing waste, although showing improvement, still requires additional motivation to meet desired expectations or standards. The factors influencing waste management behavior include knowledge, attitudes, availability of facilities, and supportive policies. Good knowledge and attitudes need to be supported by adequate infrastructure and strong policies to encourage consistent waste management behavior. Therefore, more comprehensive intervention is needed, including ongoing education, infrastructure improvements, and policy support from the local government, to ensure that household waste management can be optimally carried out in the future.

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