

Knowledge, Attitudes, and Practices towards Solid Waste Management (SWM) Among Households in Suyac Island, Sagay City, Negros Occidental, Philippines

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Abstract

The global economy is generating increasing amounts of complex waste, posing a significant threat to ecosystems and human health. Proper solid waste management (SWM) remains a significant environmental challenge in the Philippines, with issues such as improper disposal, inefficient or non-existent collection, and inadequate facilities. This study aims to assess the knowledge, attitudes, and practices of households in Suyac Island, Sagay City, Negros Occidental, Philippines, towards SWM. This research utilized a descriptive design, incorporating a validated survey questionnaire and checklist to investigate the knowledge, attitudes, and practices of residents regarding household waste management. Results found that respondents generated more non-biodegradable waste than biodegradable waste. Older respondents and those with lower education levels generated higher amounts of waste. Respondents demonstrated a strong understanding of solid waste management principles, as evidenced by their high scores (4.10-5.00) in a knowledge assessment. They were highly aware of the human-generated nature of solid waste, its environmental impact, and the importance of proper segregation and disposal. Additionally, respondents expressed positive attitudes towards waste management, including personal responsibility, participation in community clean-ups, and information sharing. They also expressed high levels of concern about the waste situation in their municipality and the importance of proper waste disposal. While respondents demonstrated a strong understanding of SWM principles and a willingness to participate in waste management initiatives, the study also highlighted the need for improvements in waste collection, storage, and disposal practices.

Keywords: Solid Waste Management, KAP, Suyac Island, Philippines

INTRODUCTION

The global economy is generating increasing amounts of complex waste, posing a significant threat to ecosystems and human health. Annually, approximately 11.2 billion tons of solid waste are collected worldwide. The decomposition of organic waste contributes roughly 5% of global greenhouse gas emissions. Municipal solid waste generation is expected to increase from 2.1 billion tons in 2023 to 3.8 billion tons by 2050 (UNEP, 2024).

Solid waste includes household, commercial, institutional, industrial, and agricultural waste, as well as street sweepings, construction debris, and other non-hazardous materials. Proper SWM remains a significant environmental challenge in the Philippines, with issues such as improper disposal, inefficient or non-existent collection, and inadequate facilities (DENR, 2024). Furthermore, the growing population, driven by economic expansion and commercialization, has exacerbated solid waste management challenges at the community level. Insufficient funding from the Internal Revenue Allotment has further hindered the implementation of effective SWM programs, projects, and policies (Cando et al., 2022).

Republic Act No. 9003, also known as the Ecological Solid Waste Management Act of 2000, outlines the Philippine government's policies for managing solid waste. The law aims to protect public health and the environment, utilize environmentally sound methods, and reduce waste through various strategies such as recycling, composting, and waste minimization. It establishes guidelines for solid waste management facilities and promotes sustainable development principles. It mandated the development of the National Solid Waste Management Framework which outlines the key components of effective waste management in the Philippines. It establishes guidelines for local governments to develop 10-year SWM plans and conduct waste analysis and characterization studies. The framework covers planning, management activities, waste generation and handling, and stakeholder involvement. By following this framework, local governments can create comprehensive and sustainable waste management strategies tailored to their specific needs (NSWMC, 2021).

Community involvement is essential for successful urban solid waste management. Public attitude and engagement are crucial to the success of any health initiative. Understanding community's knowledge, attitudes, and practices (KAP) towards solid waste management programs is an effective way to assess public involvement and engagement on waste management issues (Gaiani et al., 2018). This study aims to assess the knowledge, attitudes, and practices of households in Suyac Island, Sagay City, Negros Occidental, Philippines, towards SWM. Specifically, it seeks to determine the level of awareness and understanding of SWM principles among residents, identify factors influencing their attitudes and behaviors towards waste management, and evaluate the effectiveness of existing SWM practices in the community. The findings of this study will provide valuable

insights for developing targeted interventions to improve waste management practices and promote environmental sustainability in the region.

MATERIALS AND METHOD

Study area

This study took place on Suyac Island, approximately 2 nautical miles from Sagay City in Negros Occidental, Philippines. Negros Occidental is located in the Western Visayas region and is surrounded by the Visayan Sea and the Sulu Sea. Suyac Island is part of a 32,000-hectare marine reserve (Figure 1).

Respondents of the study

This study surveyed households on Suyac Island, a small island of 1.8 hectares with approximately 800 residents. The islanders primarily rely on fishing and marine product processing for their livelihood. As the population and demand for goods and services increase, so does waste generation. A random sample of 30 households was selected to estimate the total waste generated on the island.

Research design

This research utilized a descriptive design, incorporating a validated survey questionnaire and checklist to investigate the knowledge, attitudes, and practices of residents regarding household waste management. The objective was to gain insights into the current state of waste management awareness and practices within the community.

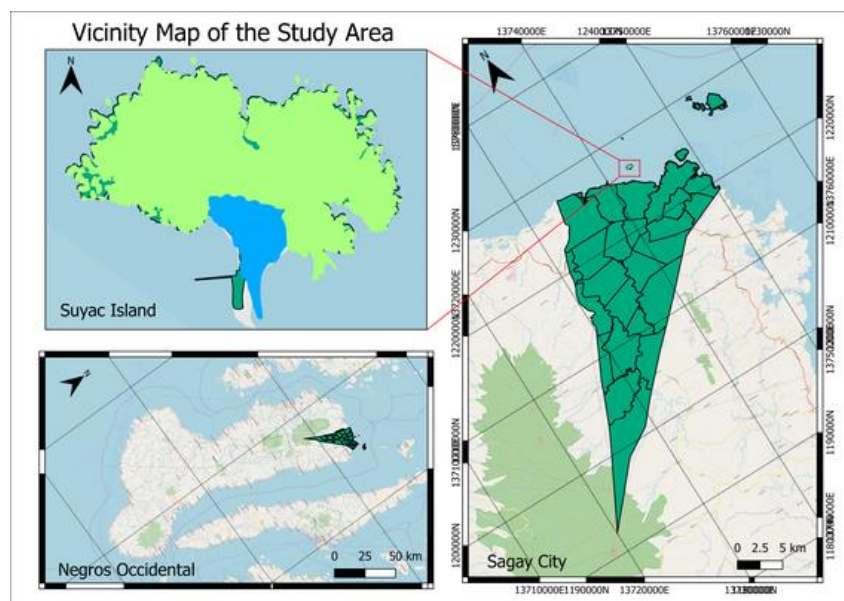


Figure 1. Vicinity map of Suyac Island, Sagay City, Negros Occidental, Philippines

Research instrument

The study used a validated questionnaire to gather information about the respondents' knowledge, attitudes, and practices regarding waste management. The questionnaire included sections on demographic data, waste generation and disposal, and knowledge, attitudes, and practices. Collected data was analyzed using mean and percentages. Respondents' knowledge, attitudes, and practices regarding solid waste management were assessed using a 5-point Likert scale (Table 1).

Table 1. Five-point Likert rating scale with mean range and verbal interpretation for KAP analysis

Range of Values (mean)	Interpretation
1.00 – 1.80	Very Low
1.81 – 2.61	Low
2.62 – 3.42	Moderate
3.43 – 4.23	High
4.24 – 5.00	Very High

Data Analysis

The collected data from the KAP survey was analyzed using descriptive statistics to summarize the respondents' knowledge, attitudes, and practices. IBM SPSS Statistics v. 26 was utilized for this analysis. Frequencies and descriptive statistics were employed to examine the respondents' responses on the questionnaires, including socio-demographic profile, knowledge, attitude, and practices.

RESULT AND DISCUSSION

Demographic and Socio-economic Profile

Majority of the respondents are married (66.7%) and female (83.33%) (Table 2). The predominance of female respondents in the survey likely reflects traditional gender roles and socioeconomic factors that often place a disproportionate burden of domestic labor on women. Despite this, women perceive their involvement in household chores to be higher than men do, yet they perceive their partners' involvement to be lower. These differing perceptions lead to unequal work-family interactions, with women experiencing more work-family conflict than men, particularly due to marital conflict stemming from domestic tasks (Cerrato and Cifre 2018). Educational attainment is moderately low with most respondents finishing secondary (36.67%) and elementary (30%) while 16.67%

fishiched college and vocational courses, respectively. This is similar to the study of Eshwari et al., (2019) where secondary education was the most common level of education among participants, with 68.03% having completed it. The low educational attainment of the households is attributed to socioeconomic factors such as poverty, environmental conditions, cultural influences, curriculum design, and health, as perceived by household heads and teachers, significantly impact educational access. Household income and family size are particularly influential determinants of educational access among rural secondary students (Bayron, 2023).

In addition, challenges to effective education include insufficient parental involvement, inadequate government funding, limited resources, unqualified teachers, and the practice of combining multiple grades in a single classroom. These issues stem from both internal school factors and external influences, such as local communities and education authorities (Plessis & Mestry, 2019).

According to the Department of Environment and Natural Resources (DENR), Philippines produces a significant amount of biodegradable waste, which can be effectively composted in agricultural areas. In contrast, the average amount of biodegradable and non-biodegradable waste generated per day by respondents in Sagay City, Negros Occidental, Philippines is shown in Figure 3. Overall, the respondents generate more non-biodegradable waste than biodegradable waste. The highest average amount of non-biodegradable and biodegradable waste is generated by respondents aged 61-70.

According to Department of Environment and Natural Resources (2022) residential waste, primarily consisting of kitchen waste, food scraps, yard waste, paper, cans, bottles, and recyclables, made up over half (59.42%) of the total municipal solid waste (MSW) in 2022. Presently, male respondents consistently generated more household waste per day than female respondents, regardless of waste type (Figure 2). Additionally, individuals with an elementary education level produced the highest average amount of both biodegradable and non-biodegradable waste compared to those with higher educational attainments. Extended families also significantly generated more waste than nuclear families.

Moreover, a study on food waste found that household size, composition, income, and age significantly influence the amount of wastes. Larger households with more adults generate more food waste overall but less per person, while lower-income households tend to waste less food than higher-income households. Additionally, younger individuals often waste more food than older individuals (Gaiani et al., 2018).

Table 2. Demographic profile of household respondents in Suyac Island, Sagay City, Negros Occidental, Philippines

Variables		Frequency	Percentage
Age	30-40	10	33.33%
	41-50	7	23.33%
	51-60	8	26.67%
	61-70	2	6.67%
	71-80	3	10.00%
Sex	Female	25	83.33%
	Male	5	16.67%
Civil status	Single	4	13.33%
	Married	20	66.67%
	Others	6	20.00%
Highest educational attainment	No proper education	0	0.00%
	Elementary	9	30.00%
	Secondary	11	36.67%
	Vocational	5	16.67%
	College	5	16.67%
	Postgraduate	0	0.00%

Most respondents have also lived in the island for 46-60 years (30 %) followed by 16-30 years (23.33%) with most household size having 4-6 members (76.67 %) and typically a nuclear type of family (56.67 %) (Table 3). This validates the findings of Lunag Jr & Elauria (2021) where family size was positively correlated with total household biowaste generation but negatively correlated with per capita biowaste generation. Households with 3 to 9 members produce an average of 0.11 kg of biowaste per person per day.

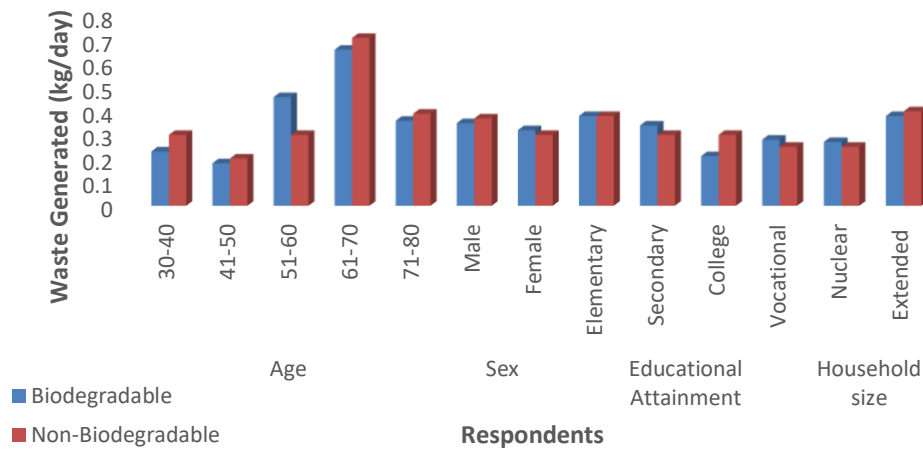


Figure 2. Household waste composition classified by demographic profile

The survey results revealed that all respondents were homeowners, and most of the households (96.67 %) have an average monthly income of Php 10,000 and below. This is corroborated in a study where income levels were found to be negatively correlated with waste generation rates, but were positively correlated with waste composition. As population and population density increased, so did per capita waste generation and total household waste generation (Ogwueleka, 2013). Furthermore, several socioeconomic factors influence the amount of daily waste generated, including education level, occupation, income, fuel sources, and others (Khan et al., 2016).

Knowledge on Solid Waste Management

The Environmental Management Bureau reports that residential waste makes up the majority (56.7%) of MSW, followed by commercial, institutional, and industrial sources. Residential waste includes food scraps, yard trimmings, paper, cardboard, glass, plastic, tissues, diapers, and hazardous items like cleaning products, batteries, and electronic waste.

Table 3. Family Structure and Income Levels of household respondents in Suyac Island, Sagay City, Negros Occidental, Philippines

Variables	Frequency	Percentage
Years of residence	0-15	4 (13.33%)
	16-30	7 (23.33%)
	31-45	6 (20.00%)
	46-60	9 (30.00%)

Household size	61-75	4	13.33%
	4-6	23	76.67%
	7-9	7	23.33%
Type of Family	Nuclear	17	56.67%
	Extended	13	43.33%
Household income	Above 25,000 per month	0	0.00%
	10,000 -25,000 per month	1	3.33%
	Below 10,000 per month	29	96.67%
Home residence type	Government-owned	0	0.00%
	Privately-owned	30	100.00%

The local government in Sagay City is actively enforcing environmental regulations to reduce plastic waste and promote sustainability. These regulations, aligned with national laws, prohibit the use of plastic bags, styrofoam, and single-use plastics. The goal is to mitigate the negative environmental effects of these materials, such as pollution and health risks. The ordinances are rooted in the principles of environmental protection and sustainable development as outlined in Philippine laws.

The findings of the knowledge assessment on waste management among household respondents in Suyac Island, Sagay City, Negros Occidental, Philippines, indicate a high level of awareness and understanding of the issue (Table 4). Respondents demonstrated a strong understanding of solid waste management, with scores consistently ranging from high to very high (4.10-5.00). Similarly, Eshwari et al. (2019) found that over 90% of participants were aware of the negative health and environmental consequences of improper waste management. The study identified education level and professional status as significant factors influencing knowledge and attitudes towards waste management.

Moreover, respondents expressed very high awareness of the human-generated nature of solid waste, its potential environmental harm, and the importance of proper segregation and disposal (5.00). Similarly, Hu and He (2022) found that rural residents who are more willing to classify waste are also more likely to dispose of it properly. Higher levels of education, income, and environmental awareness positively influence residents' willingness to dispose of waste correctly, while age has a negative effect. In addition, respondents expressed a high level of personal and community concern about the issue. These findings collectively suggest a strong foundation for implementing effective waste management initiatives in the area.

Attitude and Perception towards SWM

The results of the attitude assessment on waste management among household respondents in Suyac Island, Sagay City, Negros Occidental, Philippines, demonstrate a highly positive outlook (Table 5). On the average, the attitude of households respondents expressed strong personal responsibility for waste management (5.00), a willingness to participate in community clean-up activities (4.63), and a commitment to sharing information about waste management with others (3.73). These findings align with Kumar & Nandini (2013) in a survey that revealed that most households (63%) are open to participating in improved waste management initiatives. Also, nearly all respondents (97.8%) favor daily waste collection, and over 80% (82.5%) would be willing to segregate waste if provided with bins. Additionally, a significant majority (71%) of households expressed interest in using recycled products. Cando et al. (2022), observed a similarly high rate of reuse and recycling among participants. Additionally, the prevalence of waste segregation practices demonstrates a strong commitment to responsible waste management within households.

Table 4. Knowledge on waste management of household respondents in Suyac Island, Sagay City, Negros Occidental, Philippines

Key Indicators	Mean	SD	Interpretation
Solid Waste are generated by human activities	5.00	0.000	Very High
Solid waste is a problem elsewhere but not in my locality	5.00	0.000	Very High
Solid waste is my personal concern	4.97	0.183	Very High
Solid waste is concern of the people where I live	4.10	0.995	High
Solid wastes should be segregated	4.93	0.254	Very High
Solid wastes are caused by human population growth	5.00	0.000	Very High
Solid wastes can enter through creeks, rivers, and canals	5.00	0.000	Very High
Solid wastes can enter the marine environment	5.00	0.000	Very High
Solid waste is considered to be a threat to the environment	5.00	0.000	Very High
Our municipality is free of solid waste	5.00	0.000	Very High
Overall	4.90	0.282	Very High

Presently, respondents also displayed a very high level of concern about the waste situation in their municipality (5.00). In a similar study, majority of respondents believe that proper waste management is crucial and that individuals have a responsibility to keep their residential areas clean. Also, most respondents

are aware and attribute disease occurrence to poor waste management (Fadhullah et al., 2022).

Meanwhile, the importance of disposing waste in proper garbage container (5.00) and proper waste disposal through local authorities (4.13) were also ranging from high to very high. Integrated solid waste management systems offer solutions by systematically addressing various aspects of waste management. Efficient waste disposal systems are crucial for optimizing household waste. Implementing effective waste disposal methods can be a starting point for continuous improvement. Common waste disposal methods include storage, biological processes, thermal processes, and recovery (Arikan et al., 2017). These findings suggest a favorable attitude towards waste management practices, providing a positive foundation for implementing sustainable solutions in the region.

Table 5. Attitude on waste management of household respondents in Suyac Island, Sagay City, Negros Occidental, Philippines

Key Indicators	Mean	SD	Interpretation
I care about waste management (refuse, reduce, reuse, repurpose, recycle)	5.00	0.000	Very High
Waste management is my responsibility and not only that our municipality	5.00	0.000	Very High
Waste disposal is the responsibility of the local authorities	4.13	1.358	High
I am responsible for the generation of waste in my municipality	4.90	0.305	Very High
I believe I have a role in minimizing waste in my municipality	5.00	0.000	Very High
I am responsible for reminding other people on proper waste disposal (pick and dispose waste)	3.93	1.172	High
I read and share information on waste management with other people	3.73	1.230	High
I volunteer in municipality cleaning activities	4.63	0.964	Very High
I am concerned about the waste I saw in our municipality	5.00	0.000	Very High
I put waste into proper garbage container	5.00	0.000	Very High
Overall	4.63	0.366	Very High

Waste management practices among households

The overall practices of household respondents in Suyac Island, Sagay City, Negros Occidental, Philippines (Table 6) on waste management are generally

positive, but there are areas for improvement. Respondents demonstrate strong practices in separating and controlling waste at home (4.97 - 5.00) and participating in waste management activities (4.43 - 4.77). Several factors, including inadequate facilities, insufficient training, and limited information dissemination, were found to hinder participant involvement in waste reduction and recycling. Household size and monthly income were one of the identified significant predictors of participants' waste management practices (Limon & Villarino, 2020).

Respondents also indicated high to very high disagreement with practices related to disposing of solid waste in canals, creeks, rivers, or seas (4.86) and burning and burying unsegregated waste (3.66 – 4.00). The study found that respondents engaged in various sustainable waste management practices, including reducing waste at the source, recycling, repairing and reusing items, selling recyclable materials, segregating waste, avoiding burning waste, and participating in community clean-up activities (Aspiras et al., 2019).

Additionally, the effectiveness of waste collection methods and storage in the municipality is moderate (3.23) but obedience to laws covering waste management is very high (5.00). Despite progress in waste management, there remains significant room for improvement in collection methods, storage practices, and the disposal of unsegregated solid waste.

The island's waste collection and transportation are primarily handled by an association, but this service is limited to its members. The inconsistent collection system often leads to uncollected waste piling up outside designated bins, which may be poorly designed, inadequate in size, or improperly located. Some residents also intentionally accumulate waste to expand their territory, exacerbating the problem. Uncollected waste frequently accumulates in open areas, on the ground, or in mangrove areas. Similarly, Abubakar et al. (2022) noted that uncollected organic waste can attract rodents, insects, and reptiles, which can transmit diseases to humans. The decomposition of organic waste also produces unpleasant odors, especially in warm weather, and can contaminate groundwater and surface water through leachate. This shows how citizen behavior plays a crucial role in MSW management policies. One example is the voluntary participation of households in waste segregation initiatives, even in the absence of government-provided garbage bins (Camarillo & Bellotindos, 2021).

Many respondents reported significant difficulties in managing household waste. But a majority of these waste managers support the proposed improvement strategies for household waste management (Dibia et al., 2022).

Composting is a natural process that breaks down organic waste using microorganisms. While it can reduce organic waste significantly and produce valuable compost for agriculture, composting releases more carbon dioxide into the atmosphere compared to other waste disposal methods (Ayilara et al., 2020). On the other hand, household recycling behavior is influenced by various factors and may not follow a predictable pattern when new recycling programs are implemented. Understanding the relationships between different waste fractions is

crucial for accurately predicting household waste generation and composition (Edjabou et al., 2021). The presence of recyclable materials like paper, cardboard, plastics, and metals offers potential for recycling. Segregation at the household level is crucial for maximizing the recovery of these materials (DENR, 2022).

Table 6. Practices on waste management of household respondents in Suyac Island, Sagay City, Negros Occidental, Philippines

Key Indicators	Mean	SD	Interpretation
Control of waste in our house is done on a regular basis	4.73	0.740	Very High
Separation of waste at household is ensured to help in waste management of the municipality	5.00	0.000	Very High
Waste collection method and storage of waste is effectively observed in the municipality	3.23	0.971	Moderate
At home, I separate the waste of plastic, paper, glass, etc. before their disposal	4.97	0.183	Very High
I dispose solid waste in in the canals, creeks, rivers or seas	4.86	0.747	Very High
I burn unsegregated solid wastes	4.00	0.890	High
I bury unsegregated solid wastes	3.66	1.098	High
I participate in programs and seminars regarding solid wastes	4.43	1.104	Very High
I volunteer or join in activity, like clean up	4.77	0.679	Very High
I obey the laws covering waste management	5.00	0.000	Very High
Overall	3.77	0.255	High

Waste disposal methods in the area involve uncontrolled dumping, open-air burning, and landfills. These practices have severe negative consequences, including air and water pollution, land degradation, the release of harmful gases like methane and leachate, and contributions to climate change. These environmental and health hazards disproportionately affect marginalized communities (Abubakar et al., 2022). Uncontrolled dumping often occurs in public areas like front yards, ditches, and streets. Respondents recognize the health risks associated with littering and dumping, including the spread of diseases, environmental pollution, and blocked drainage channels. These practices pose a danger to children and negatively impact the health and well-being of nearby residents. Despite warning signs, dumping continues to occur in designated hotspots (Viljoen et al., 2021).

Furthermore, the lack of Material Recovery Facilities (MRFs) in the island was a primary barrier to resident participation in waste recycling. Even in areas where MRFs were present, their design and functionality often did not meet the necessary standards, limiting their effectiveness (Camarillo & Bellotindos, 2021).

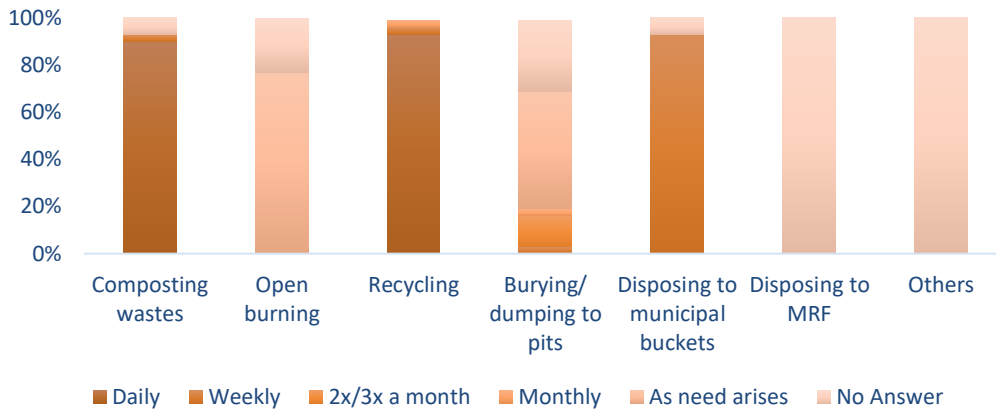


Figure 3. SWM strategies and practices among household respondents in Suyac Island, Sagay City, Negros Occidental, Philippines

The study of Camarillo and Bellotindos (2021) the lack of dedicated collection systems or accessible drop-off points for recyclable materials, especially hazardous components, increases the risk of these items being improperly disposed of through incineration or landfilling. In addition, significant deficiencies evident in the final disposal facilities and overall recycling and composting efforts could result to moderate compliance in waste collection, transportation, and enforcement activities. In order to enhance resident participation and improve SWM outcomes, the implementation of effective recycling and composting programs is strongly recommended

In developing countries, people's knowledge, physical circumstances, and government incentives can impact their willingness to participate in household waste sorting. However, the relationships between these factors and other highly correlated variables require further investigation. Despite extensive research on socio-demographic factors, they have a minimal influence on waste sorting participation (Rousta et al., 2020). Furthermore, municipalities and households must work together to address waste management challenges in rural areas. In cases of financial limitations, exploring collaborative solutions with neighboring towns is also essential for effective waste management (Viljoen et al., 2021).

CONCLUSION

This study explored the knowledge, attitudes, and practices of household respondents in Suyac Island, Sagay City, Negros Occidental, Philippines, towards

SWM. The findings revealed a high level of awareness and understanding of SWM issues among respondents. However, despite positive attitudes and practices, challenges persist in waste management, particularly in collection, storage, and disposal. While respondents demonstrated a strong understanding of SWM principles and a willingness to participate in waste management initiatives, the study also highlighted the need for improvements in waste collection, storage, and disposal practices. To address these challenges, municipalities and households must collaborate, explore alternative solutions, and seek financial support. By investing in infrastructure, enhancing public awareness, promoting partnerships, and exploring innovative approaches, Suyac Island can significantly improve its solid waste management practices and create a more sustainable environment for its residents.

CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest.

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