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Implementation of Ecological Solid Waste Management City Ordinance: The Case of a Component City in Southern Negros

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Authors' contributions

This work was carried out in collaboration between both authors. Author ATSJ is the main proponent who wrote the paper, designed the study and performed the data analysis and interpretation through the guidance and recommendations of author KJAL as his adviser and on the other hand, checked and addressed the alignment of the writing from the formulation of the research objectives, framework, methods, analysis and interpretation, conclusion, and the journal format. Both authors read and approved the final manuscript.

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ABSTRACT

Aims: This study determined the extent of implementation of ecological solid waste management activities: waste generation and storage, waste processing and resources recovery, collection and transportation, and disposal of solid wastes in communities in a component city in Negros Occidental as assessed by the city implementers, barangay implementers, and residents when taken as a whole and when barangays are grouped according to geographical location, population, land area, and income classification. Lastly, the findings of the study were utilized in the formulation of a strategic plan for enhanced implementation of the city's comprehensive solid waste management program.

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Study Design: The study utilized the quantitative design particularly the descriptive-comparative approach.
Place and Duration of Study: The study was conducted in the barangays of a component city in Southern part of Negros Occidental Philippines during school year 2022.
Methodology: The study used a descriptive-comparative research design utilizing a survey questionnaire for data collection. Only Five hundred thirteen (513) respondents participated in the study and the seven (7) others refused to answer the survey questionnaire. Total enumeration was employed for city implementers. Stratified random sampling was used to identify the respondents for barangay and community leaders for each stratum to be well represented. Purposive sampling was used in data collection. In the same way, purposive sampling was used in the conduct of interviews. To analyze the descriptive data, Mean, Standard Deviation, and Frequency Count were also used. Kruskal Wallis and Mann-Whitney U tests were utilized for comparative analysis. More so, general moral principles of respect for persons, beneficence, and justice to ensure the ethical soundness of the study are addressed in the study.
Results: The result shows no significant difference in the implementation when communities are grouped according to population. However, a significant difference was found when communities were grouped according to location, land area, and income. When it comes to demographics of the respondents in the component city in Southern Negros. In terms of respondents, 1.8% (f=9) were city implementers, 25.0% (f=128) were barangay implementers, and 73.3% (f=193) were community leaders. Among the three (3) implementers, the majority were the community leaders in the component city. Meanwhile, in regards to location, 40.0% (f=205) of respondents came from upland location, 37.6% (f=193) stayed at mainland, and 22.4% (f=115) lived in coastal location. Dominantly, respondents from the upland location obtained the highest percentage among the location. When it comes to population, 73.9% (f=379) belonged to the smaller population with 5933 and below, and 26.1% (f=134) was from a bigger population with 5934 and above. The majority belonged to a smaller population that dominated the study. Similarly, in terms of land area, 73.9% (f=379) of the respondents were from a smaller area (1931 and below), while 26.3% (f=135) were from a bigger area (1932 and up). Finally, in terms of income classification, 68.6% (f=352) of respondents belonged to the barangays with a lower income of 806880 and below, while 31.4% (f=68.4) belonged to the barangays with a higher income of 8068808 and up. Respondents residing in lower-income areas have fewer sources of living, income, and resources.

Keywords: Social Science; public administration; solid waste management; quantitative; Philippines.

1. INTRODUCTION

Local governments play a critical role in the majority of developing countries in providing inclusive, commercially sustainable, and institution-based solid waste management (SWM) [1]. SWM is seen as a practical framework that supports sound governance and forms the social, economic, and environmental pillars of sustainable development [2]. The World Bank [3] forecasts that solid waste production will double by 2050 due to the rapid rise in the global population. This leads to an issue that impacts every individual, family, community, and government [4]. These factors prompted the development of laws and policies for solid waste management and international collaboration [5].

The issue of increased urbanization brought on by rising economies drives the production of solid garbage in the Asian Region [6]. Currently, the Association of Southeast Asian Nations (ASEAN) member states are striving to improve their waste management due to several obstacles [7], particularly in the areas of disposal/collection, such as open burning, open dumping, and similar practices. Even though there have been certain advancements, such as in national laws and regulations, the development is still insufficient [8].

The Philippines has endeavored to improve its solid waste management through the passage of RA 9003, otherwise known as the Ecological Solid Waste Management Act of 2000, which provides for a systematic, comprehensive, and ecological waste management program to ensure the protection of public health and the environment. Consequently, the ESWM is expected to assist Local Government Units in implementing RA 9003, particularly in the development of their 10-year SWM Plan, closure

and rehabilitation of dumpsites, the establishment of Materials Recovery Facilities, and an environmentally sound disposal system [9]. According to Kaza et al. [10], waste generation is strongly associated with urbanization, economic development, and population growth in the literature. Its rate of increase is thought to be driven by rapid urbanization, lifestyle changes, and consumption patterns, which inevitably lead to more greenhouse gases. The record amount of material generated was about 39,422 tonnes, which was expected to double by 2025 [11].

In Negros Occidental, according to the Department of Environment and Natural Resources (DENR), it has surpassed its 2018 targets under its Solid Waste Management (SWM) Program, indicating improved compliance by local government units (LGUs) to Republic Act No. 9003. Furthermore, it also specifies actions such as information dissemination strategies to residents, the presence of materials recovery facility and sanitary landfill, biodegradable waste process, and partnerships with organizations for their recycling.

Numerous researches were produced due to the ecological SWM implementation in the Philippines. Some studies emphasize managing solid waste through community participation, methods, and policy implementation [12,13]. Studies on the attitudes, behaviors, and practices surrounding the application of SWM in schools have been undertaken by both public and private organizations [14,15,16]. Research on the implementation of ESWM barangays in a highly urbanized city in Western Visayas was conducted by Go and Caelian [17]. Even though several academics have investigated ESWM, none of the studies cited addressed how well a component city in southern Negros Occidental was implementing SWM activities. Hence, there is a clear vacuum in the literature that the study set out to bridge.

1.1 Research Problem

This study determined the extent of implementation of ecological solid waste management activities: waste generation and storage, waste processing and resources recovery, collection and transportation, and disposal of solid wastes in communities in a component city in Negros Occidental as assessed by the city implementers, barangay implementers, and residents when taken as a whole and when barangays are grouped according to geographical location, population, land area, and income classification.

1.2 Theoretical Framework

This study theorized that the proper implementation of ecological solid waste management in communities of a component city might vary in terms of their geographical location, population, land area, and income classification. The Evolutionary Governance Theory was used to analyze and explain governance and its evolution. It is an approach that addresses the complex and non-linear nature of governance. Evolutionary governance theory is a governance theory that establishes some fundamental guidelines for how any sort of good government must be managed. These values include responsibility, control, response, transparency, public involvement, thrift, and effectiveness. Solid waste management is a clear indicator of the effectiveness of management structures. When waste management works well, societies' administrative processes, procurement policies, labor practices, accounting, cost recovery, corruption, poverty, and justice management are also likely to work well. Similarly, one of the first areas to address in waste management is governance. According to Hashim et al. [18], cities have failed to develop clear policies and strategies to promote sustainable solid waste management.

2. METHODOLOGY

2.1 Research Design

This study used a descriptive-comparative research design which considered two variables that were not manipulated and established a formal procedure to conclude that one is better than the other [19]. The above design was appropriate for the study as it explored and described the correlations of two or more variables conceivably identified as characteristics in an experiential phenomenon or the exploratory to highlight the prevalence of statistical differences within subjects.

2.2 Respondents

The respondents were the 520 implementers composed of city implementers, barangay implementers, and community leaders in charge of the implementation of ESWM. Total enumeration was employed for city

implementers, stratified random sampling for barangay implementers, and purposive sampling for residents based on the number of registered voters in the May 2022 elections.

Table 1. Distribution of respondents

Respondents	N	n	%
City Implementers	9	-	
Barangay Implementers	190	128	
Residents	71,169	383	
Total	**71,368**	**520**	**100.00**

2.3 Research Instrument

A researcher-made instrument was used to assess the extent of the implementation of solid waste management activities in a component city based on their existing Ecological Solid Waste Management Ordinance. The instrument was a paper-pencil self-administered instrument. The questionnaire was divided into two (2) parts: Part I of the questionnaire was for the Respondent's Profile, and Part II included 37 items of Likert-type statements that determine the extent of implementation of ecological solid waste management activities from waste generation and storage to disposal of solid waste.

The survey instrument was researcher-made, it was subjected to validity and reliability tests. The content validity ratio (CVR) by Lawshe [20] was used to measure the validity. It was presented to a panel of five experts who rated the items into three categories: "essential," "useful but not essential," and "not essential." Items deemed essential by a critical number of experts were included, and things failing to achieve the critical level were discarded. The content validity index result was 1.00, denoting that all items in the questionnaire were valid.

After the validity of the questionnaire was established, the questionnaire was subjected to a reliability test to ensure that the questions included could measure what they aimed to measure. A pilot test was conducted on thirty (30) residents and implementers who were not respondents to the actual study. To determine the reliability, a Cronbach Alpha was used to compute the reliability score resulting in 0.747, which shows that the instrument was reliable.

2.4 Data Analysis

Descriptive and comparative analyses were used in the study. Frequency count and percentage distribution were used for the demographic profile of the respondents. Mean and standard deviation were used to measure the extent of the implementation of ESWMA from waste generation and storage, waste processing and resources recovery, collection and transportation, and disposal of solid wastes in barangays in a component city in Negros Occidental as assessed by the respondents and when barangays are grouped according to geographical location, population, land area, and income classification.

3. RESULTS AND DISCUSSION

3.1 Profile of the Respondents

Table 1 shows the demographic profile of the respondents in the component city in Southern Negros. In terms of the classification of respondents, 1.8% (f=9) were city implementers, 25.0% (f=128) were barangay implementers, and 73.3% (f=193) were community leaders. Among the three (3) classes of implementers, the majority were community leaders in the component city. Meanwhile, Table 2 shows in regards to location, 40.0% (f=205) of respondents came from upland locations, 37.6% (f=193) stayed on the mainland, and 22.4% (f=115) lived in coastal locations. Dominantly, respondents from the upland location obtained the highest percentage.

In terms of population, 73.9% (f=379) belonged to the smaller population, with 5933 residents and below, and 26.1% (f=134) was from a bigger population, with 5934 residents and above. The majority belonged to a smaller population that dominated the study. Similarly, in terms of land area, 73.9% (f=379) of the respondents were from a smaller area (1931 and below), while 26.3% (f=135) were from a bigger area (1932 and up). Finally, in terms of income classification, 68.6% (f=352) of respondents were from the barangays with a lower income of Php806880 and below, while 31.4% (f=68.4) were from the barangays with a higher income of Php8068808 and up. Respondents residing in lower-income areas have fewer sources of living, income, and resources.

Understanding the location bracket of a population yields insights into the barangay's extent of solid waste management. It is important to determine the population, area, and income status of the respondents because these could affect how they answered the survey. In this study, the majority of the respondents belonged to a lower population, area, and income.

Table 2. Profile of the Barangays

Variable	Frequency	Percentage
Location		
Mainland	193	37.6
Coastal	115	22.4
Upland	205	40.0
Population		
Smaller (5933 and below)	379	73.9
Bigger (5934 and above)	134	26.1
Area		
Smaller Area (1931 and below)	378	73.7
Bigger Area (1932 and up)	135	26.3
Income		
Lower (Php8068807 and below)	352	68.6
Higher (Php8068808 and up)	161	31.4
Total	**513**	**100.0**

Note: Average population=5933.2, Average Area=1931.7, Average Income=Php8068807.2

3.2 Extent of Implementation of Ecological Solid Waste Management Activities

Table 3 shows the extent of implementation of the ecological solid waste management activities in communities in a component city in Negros Occidental. As a whole, a great extent (M=3.83; SD=0.53) was found in the implementation of solid waste management activities (SWMA). The result shows that communities of the component city implement most provisions of the city ordinance on ecological solid waste management (ESWM). Among the activities, the disposal of solid waste was rated as the highest (M=3.93; SD=0.58), interpreted to a great extent. It was followed by waste generation (M=3.85; SD=0.59), collection and transportation of solid waste (M=3.82; SD=0.71), and all, which are interpreted to a great extent. On the other hand, waste processing and resources recovery (M=3.72; SD=0.67) had the lowest mean score but was still interpreted to a great extent.

As a whole, the results show that communities observe proper solid waste management regardless of the ESWM activities and their demographics. Each community in the component city also showed appropriate behavior and practices, from solid waste generation to waste disposal. Moreover, a great extent of ESWM implementation depicts that respondents of the study are well-informed/educated vis-à-vis good practices in ESWM. In addition, members of the community showcase a sense of responsibility in managing their solid wastes. Thus, good environmental governance is properly observed. Also, they are aware of the implementing rules and regulations of the existing law in the environment, specifically the Republic Act 9003 and their local ordinances relating to ESWM.

According to Trondillo et al. [21], managing waste is a personal duty; hence, it is critical to know the strategies currently used for managing solid waste. Madrigal and Oracion's [15] stated that a high degree of behavior and practices in solid waste management builds awareness strategies and attitudes toward the impact of waste problems. This conclusion is consistent with the findings of the current study.

The disposal of solid wastes had the highest mean score among ESWM activities (M=3.93; SD=0.58), which is interpreted as having a significant scope. The outcome demonstrates that most procedures and/or guidelines for solid waste disposal are followed. In light of this, communities, especially the respondents, have access to a range of needs and support services for ESWM resources, settings, and gear. Additionally, communities were introduced to different programs, projects, and/or activities (PPA) mandated by the law relating to environmental management, more specifically trash management, including recycling and composting, through the efforts of the local government unit.

Based on the research of Nyampundu et al. [4], SWM services were said to be given by the city council with the primary tools and equipment required to store solid wastes (SW), helping to ensure that appropriate solid waste management was successfully implemented. Consequently,

the aforementioned study supports the findings of the investigation. Contrarily, the study by Fernando [22] reveals that the majority of programs put into place by municipal councils and other local governments with the necessary authorities for managing solid waste were unsuccessful, which runs counter to the study's findings.

Meanwhile, waste processing and resources recovery (M=3.72; SD=0.67) had the lowest mean rating as assessed by the respondents. However, it is worth mentioning that this activity's mean score is still interpreted to a great extent. This means that there is still a gap in the implementation of these ESWM activities among communities. Despite the solid waste management approaches and strategies introduced by the local government units and implementing offices/agencies in the locality in the communities, there are some other schemes concerning SWM that they need to learn and incorporate into their day-to-day living. This can also be attributed to the capability of the barangay to process the solid waste collected, as it requires human and monetary capital. Introduction to more innovative and high-tech waste processing and relevant resource recovery tools may be necessary.

Joshi and Ahmed [23] noted in their study that cities and towns from developing countries should begin installing decentralized solid waste processing units and building a formal recycling industrial sector to support the study's findings. Therefore, it is necessary to change company models, rules, and process technology [24].

3.3 Implementation of Ecological Solid Waste Management Activities and Respondents

When grouped according to the classification of respondents, city implementers showed a very great extent of implementation (M=4.63; SD=0.40) of ecological solid waste management activities. This shows that city implementers follow and observe all the activities in ESWM. On the other hand, barangay implementers (M=4.01; SD=0.48) and community leaders (M=3.75; SD=0.52) assessed the implementation as significantly lower than the city implementers but still interpreted it to a great extent.

The result reveals that city implementers assessed their implementation as the highest among the respondents. City implementers are part of the officials and employees who are directly managing the implementation of ESWMA. Thus, they lead as an example to others. More so, they are the group that knows the implementing rules and regulations and penalties for non-compliance pertaining thereto; thus, they properly observed ESWMA. In addition, city implementers have the capability to allocate funds to their office concerning the implementation of ESWM. Hence, city implementers are more privileged with the services received.

On the other hand, barangay and community implementers have the lowest mean. This shows that respondents, such as barangay and community implementers, are the implementers who are dependent on the information and services offered from/by the higher offices in the city. More so, with the area classification, land area, land classification, and or population that they are serving, proper implementation every now and then is being neglected and sometimes disregarded. In addition, barangay and community implementers have limited access to immediate information, and planning sessions in the city regarding solid waste management despite environmental concerns are part of assessing good governance. On the other hand, their opportunity and involvement in decision-making in ESWM implementation rarely happened when deemed necessary. Nonetheless, barangay and community implementers are trying their best to implement to the best of their abilities, as shown in the great extent of the assessment.

The study's findings align with those of Lalamonan and Comighud [25], who found that the respondents had a very high and significant degree of knowledge of and use of SWM practices. This is backed up by Almazan and Vargas [26], who claim that despite difficulties, those responsible for carrying out the terms of RA 9003 were adamant about doing so. The results of Trondillo et al. [21] are also consistent with the conclusion that most research barangays were knowledgeable about the programs already in place and competent in SWM. A planned, methodical application of SWM can be advantageous from an environmental, social, and economic perspective, according to Sahar [27].

In contrast, local government entities typically struggled to execute the SWM due to a lack of capability, comprehension, and enforcement authority. Hence, with little knowledge of SWM,

there were issues with the economy and the environment [28]. In addition, resource usage was one of the SWM system's inefficiencies, according to Tsai et al. [29].

3.4 Implementation of Ecological Solid Waste Management Activities in Terms of Geographical Location

When grouped according to geographical location, the implementation of Ecological Solid Waste Management activities shows that the mainland obtained a great extent (M=3.88; SD=0.58) of ESWM implementation, similar to upland communities (M=3.87; SD=0.42), with coastal location (M=3.68; SD=0.58) as the lowest but interpreted as a great extent. The result shows that despite the great extent of implementation in terms of the geographical location, the mainland location was greatly privileged to receive opportunities, information, and other innovative knowledge and accessible materials or facilities because most of the higher offices were in their vicinity. The mainland location is also the center for law enforcement, wherein prohibited acts relating to the implementation of ESWM exist. As a center of trade, business, and industry and an image of the city, the implementation of ESWM must be properly observed and maintained at all times.

On the other hand, coastal and upland locations were somehow left one step behind by the mainland, considering their distance, accessibility, and convenience. Upland locations are where the agricultural sectors reside; thus, solid waste in the upland areas is minimal, and implementation of such ordinance is somewhat not strict enough. The coastal locations were considered slumps and thickly populated areas, so enforcement of ESWN cannot be materialized. In addition, facilities in coastal areas are minimal to enforce the set laws and regulations of the environmental office concerned effectively. Furthermore, residents from these locations are not fully equipped with ESWM information, the culture of resourcefulness and creativity, and different approaches to processing their wastes and practicing F's scheme (feed, fermentable, food, and fuel). Hence, a greater edge is provided on the mainland than in the other locations.

As to geographical location, Go and Caelian [17] found that sub-urban barangays' enforcement of illegal activities is higher than that of urban barangays'. Ghosh and Ng [30] argue in favor of making diverse waste management techniques necessary in rural areas to execute the SWM more effectively. On the other hand, according to Khan et al. [6], other coastal cities were always in danger of environmental contamination, with no regulations on how garbage was disposed of and no integrated solid waste management system. Furthermore, Abdel-Shafy and Mansour [31] report that the collection and disposal of solid wastes in both urban and rural areas of many developed and developing countries has experienced a severe and pervasive issue. The disposal of solid wastes is one of the biggest issues facing the urban environment in most countries worldwide. Urban and Nakada's [32] findings, which are pertinent, show that improper solid waste disposal was allegedly present in several cities. Over 35% of garbage disposed of could have negative health effects. It follows that "rules and regulations must be explicit and formulated using a bottom-up method to guarantee that the changes reflect cultural and specific local demands in the area" [33].

3.5 Implementation of Ecological Solid Waste Management Activities in Terms of Population

When grouped according to population, the bigger population showed a great extent of implementation (M=3.88; SD=0.52), which is higher than the smaller population, which obtained a result interpreted to as great extent (M=3.81; SD-0.53) as well. Thus, both groups of respondents are all the required activities in ESWM.—Despite the bigger number of populations, residents are highly equipped with the necessary rules and regulations set by their community. Since they are good enough to manage their waste and daily waste consumption, they responsibly implement waste segregation and disposal, maybe because of the notices from the growing number of commercial buildings, food stalls, and "carinderias." Thus, a bigger population has bigger chances to learn and relearn new concepts of ESWM among their residents with different backgrounds.

However, despite the great extent of the smaller population, communities have not been further introduced to innovative and relevant concepts on ESWM. Their small number contributes to limited access to resource mobilization and collaboration with other communities. Thus, it is necessary to generally empower the small population communities with varying waste characterization and generation patterns to pay attention to ESWM.

Table 3. Extent of Implementation of Ecological Solid Waste Management Activities in terms of Geographical Location

Variable	Waste Generation and storage			Waste Processing and Resources Recovery			Collection and Transportation of Solid Wastes			Disposal of Solid Wastes			Implementation		
	M	**SD**	**Int**	**M**	**SD**	**Int**	**M**	**SD**	**Int**	**M**	**SD**	**Int**	**M**	**SD**	**Int**
Assessors															
City Implementers	4.64	0.4	VGE	4.51	0.58	VGE	4.64	0.47	VGE	4.73	0.28	VGE	4.63	0.4	VGE
Brgy Implementers	3.97	0.48	GE	3.81	0.61	GE	4.14	0.87	GE	4.1	0.54	GE	4.01	0.48	GE
Residents	3.79	0.61	GE	3.68	0.68	GE	3.69	0.61	GE	3.85	0.57	GE	3.75	0.52	GE
Location of the Communities															
Mainland	3.91	0.67	GE	3.8	0.71	GE	3.85	0.64	GE	3.97	0.63	GE	3.88	0.58	GE
Coastal	3.67	0.6	GE	3.56	0.69	GE	3.72	1	GE	3.76	0.58	GE	3.68	0.58	GE
Upland	3.9	0.49	GE	3.75	0.6	GE	3.85	0.57	GE	3.98	0.51	GE	3.87	0.42	GE
Whole	**3.85**	**0.59**	**GE**	**3.72**	**0.67**	**GE**	**3.82**	**0.71**	**GE**	**3.93**	**0.58**	**GE**	**3.83**	**0.53**	**GE**

Mean Scale: 1.00-1.80=Very Low (VLE), 1.81-2.60=Low (LE), 2.61-3.40=Moderate (ME), 3.41-4.20=Great (GE), 4.21-5.00=Very Great (VGE)

Table 4. Extent of Implementation of Ecological Solid Waste Management Activities in terms of Population

Variable	Waste Generation and storage			Waste Processing and Resources Recovery			Collection and Transportation of Solid Wastes			Disposal of Solid Wastes			Implementation		
	M	**SD**	**Int**	**M**	**SD**	**Int**	**M**	**SD**	**Int**	**M**	**SD**	**Int**	**M**	**SD**	**Int**
Population of the Communities															
Smaller	3.84	0.59	GE	3.68	0.67	GE	3.8	0.75	GE	3.94	0.59	GE	3.81	0.53	GE
Bigger	3.88	0.6	GE	3.85	0.65	GE	3.89	0.6	GE	3.9	0.57	GE	3.88	0.52	GE
Whole	**3.85**	**0.59**	**GE**	**3.72**	**0.67**	**GE**	**3.82**	**0.71**	**GE**	**3.93**	**0.58**	**GE**	**3.83**	**0.53**	**GE**

Mean Scale: 1.00-1.80=Very Low (VLE), 1.81-2.60=Low (LE), 2.61-3.40=Moderate (ME), 3.41-4.20=Great (GE), 4.21-5.00=Very Great (VGE)

Table 5. Extent of Implementation of Ecological Solid Waste Management Activities in terms of Land Area

Variable	Waste Generation and storage			Waste Processing and Resources Recovery			Collection and Transportation of Solid Wastes			Disposal of Solid Wastes			Implementation		
	M	**SD**	**Int**	**M**	**SD**	**Int**	**M**	**SD**	**Int**	**M**	**SD**	**Int**	**M**	**SD**	**Int**
Land Area of the Communities															
Smaller Area	3.82	0.62	GE	3.67	0.69	GE	3.78	0.76	GE	3.88	0.61	GE	3.79	0.56	GE
Bigger Area	3.93	0.50	GE	3.88	0.57	GE	3.94	0.55	GE	4.05	0.49	GE	3.95	0.40	GE
Whole	**3.85**	**0.59**	**GE**	**3.72**	**0.67**	**GE**	**3.82**	**0.71**	**GE**	**3.93**	**0.58**	**GE**	**3.83**	**0.53**	**GE**

Mean Scale: 1.00-1.80=Very Low (VLE), 1.81-2.60=Low (LE), 2.61-3.40=Moderate (ME), 3.41-4.20=Great (GE), 4.21-5.00=Very Great (VGE)

Table 6. Extent of Implementation of Ecological Solid Waste Management Activities in terms of Income Classification

Variable	Waste Generation and storage			Waste Processing and Resources Recovery			Collection and Transportation of Solid Wastes			Disposal of Solid Wastes			Implementation		
	M	**SD**	**Int**	**M**	**SD**	**Int**	**M**	**SD**	**Int**	**M**	**SD**	**Int**	**M**	**SD**	**Int**
Income of the Communities															
Lower	3.82	0.60	GE	3.66	0.68	GE	3.78	0.77	GE	3.92	0.59	GE	3.80	0.53	GE
Higher	3.91	0.58	GE	3.87	0.63	GE	3.91	0.58	GE	3.94	0.57	GE	3.91	0.50	GE
Whole	**3.85**	**0.59**	**GE**	**3.72**	**0.67**	**GE**	**3.82**	**0.71**	**GE**	**3.93**	**0.58**	**GE**	**3.83**	**0.53**	**GE**

Mean Scale: 1.00-1.80=Very Low (VLE), 1.81-2.60=Low (LE), 2.61-3.40=Moderate (ME), 3.41-4.20=Great (GE), 4.21-5.00=Very Great (VGE)

Joshi and Ahmed [23] claim that people living in areas with a higher density have different patterns of trash generation and consumption. Population growth causes waste challenges, such as transportation waste and issues with infrastructure services [34]. Additionally, Ahluwalia and Patel [35] note that due to the continued practice of combining non-biodegradable and biodegradable trash, constrained location, and rapid population increase, resource recovery from waste is typically disregarded. Therefore, due to increased resource use and waste production brought on by economic growth, the environment is harmed and polluted. Because of the negative environmental implications of present waste disposal practices, accountability is necessary for an efficient waste management system [36].

3.6 Implementation of Ecological Solid Waste Management Activities in Terms of Land Area

In terms of assessment using the land area, the bigger land area (M=3.95; SD=0.40) implemented to a great extent of ESWM, similar to the smaller land area (M=3.79; SD=0.56), though with a slightly lower mean. This means that regardless of the land area of the communities, residents performed a great extent of implementation in their day-to-day activities with a sense of responsibility, managing their wastes. A bigger land area has a wider area to build ESWM facilities like dump sites, collection areas, or Material Recovery Facilities. As a result, they refrain from illegally dumping their wastes in alleys, riverbanks, and public places. A bigger land area proves that more ESWM activities can be done.

Meanwhile, communities with smaller land areas might have an insufficient property to put up their ESWM facilities, such as their waste landfill, resource recovery area, and disposal sites. Likewise, smaller land areas have limited spaces to organize ESWM programs and initiatives, leading to readjusting landfills to serve the community. However, despite the small area, communities could implement ESWM activities responsibly. According to the findings, only 81% of rural inhabitants in the study by Wang et al. [37] disposed of their trash in approved dumping sites. No matter how big or small the place, people will develop a routine to dispose of their waste if there are dumps. However, despite the effective solid waste laws imposed at the local level, some smaller communities could not organize themselves adequately for this execution, relying instead on the plan and efficient management of public services. Although some municipalities offered ways to put goals and initiatives into action, numerous smaller municipalities struggled with the proper organization [38].

3.7 Implementation of Ecological Solid Waste Management Activities in Terms of Income Classification

When classified according to income classification, the higher income group (M=3.91; SD=0.50) implemented ESWM activities to a great extent, similar to the lower income group (M=3.80; SD=0.53), which had a great extent of ESWM implementation. This indicates that the higher income group could provide and sustain ESWM needs and services because of existing funds. Communities with higher incomes basically have various resources in their barangays; hence, they were able to improve their waste management system. Similarly, residents in the communities with higher income can benefit from the ESWM materials, facilities, equipment, land property, and advocacy programs. Hence, a great extent was found.

On the other hand, communities with lower income struggle with insufficient funds to provide for their residents, despite the great extent of implementation. This also implies that their lower income could still suffice their ESWM needs. However, they must still strengthen their partnership with external organizations or agencies to implement the necessary ESWM activities. In terms of waste processing and resource recovery, communities got much more concerned about recycling their waste due to insufficient funds from their local offices. Thus, income generation from waste may greatly help the communities cater to their needs. The study's findings are reinforced by Adzawla et al. [39], who concluded that socioeconomic factors other than income had a significant impact on the disposal of solid waste at prohibited locations. In order to improve solid waste management systems, ongoing advocacy campaigns must be pushed and led by various decentralized governance organizations. According to Nanda and Berruti [40], the composition of solid wastes varies depending on income, with high-income populations producing more wastepaper, metals, and glass than low-to-middle-income populations. Furthermore, the formation of solid waste is inevitable because it is made up of

materials wasted as a result of any human activity, and its volume is significantly dependent on the lifestyle of the people and their socioeconomic position [6].

3.8 Implementation of Ecological Solid Waste Management Activities in Terms of Geographical Location

Kolmogorov-Smirnov was used to determine the normality of the variables. The normality test revealed that the variable implementation [KS=0.089, p=0.000] is not normally distributed. Kruskal Wallis was used to determine the significant difference in the extent of implementation of ecological solid waste management when communities are grouped according to geographical location. Meanwhile, the Mann-Whitney U test was used when grouped according to population, area, and income. Table 7 shows that there is a significant difference in the extent of implementation of ecological solid waste management when communities are grouped according to geographical location. The computed p-value of p=0.000 with x^2=17.092 was lesser than the 0.05 level of significance, indicating that there is a highly significant difference in the extent of implementation of ecological solid waste management when communities are grouped according to geographical location. This means that the location of the barangays affects the level of ecological solid waste management, hence rejecting the null hypothesis.

With the geographical location, there are also different opportunities and services given by every locality, especially local authorities and offices. According to Yukalang et al. [33], different areas have different waste management strategies. The implementation of appropriate policies and plans, waste reduction through a waste separation system, the start of collection services, community information drives, and outside support from various offices, organizations, institutions, or agencies are just a few of the different approaches that should be used to address the current practices in implementing ESWM. Tangwanichagapong et al. [41] revealed that environmental awareness and knowledge are insufficient to promote pro-environmental behavior. It is important to build a more sensitive and empathetic behavior among the communities in promoting ecological management. Mainland, coastal, and upland areas vary according to the approach applied by the implementers in the communities.

In addition, respondents from lower-income areas scored significantly lower than higher-income areas. Communities with lower income have concerns about purchasing their ESWM materials and needs, accessing capacity-building programs, and availability of resources and funds to materialize some of their plans. This is backed up by The World Bank [42], which claims that residents of impoverished urban communities were more negatively impacted by unsustainable waste management than those in industrialized nations. Additionally, it is said that in low-income nations, over 90% of waste is typically dumped in uncontrolled landfills or burned outdoors. These actions negatively affect the environment, public safety, and health. Lalamonan and Comighud's [25] findings that there was a substantial variation in the degree of SWM practice implementation suggest that, regardless of the region, there is a need to strengthen SWM execution and implementation.

Table 7. Difference in the extent of implementation of ecological solid waste management in terms of geographical location

Variable	χ^2	df	P
Geographical Location	17.091*	2	0.000

*Note: *difference is significant when p≤0.05*

3.9 Implementation of Ecological Solid Waste Management Activities in Terms of Income Classification

Table 8 reveals that there is no significant difference in the extent of implementation of ecological solid waste management when communities are grouped according to smaller and bigger population. The computed p-value of p=0.114 with U=23062.5 is greater than the 0.05 level of significance, indicating that there is no significant difference in the extent of implementation of ecological solid waste management when communities are grouped according to population. This means that the population of the barangays does not affect the level of ecological solid waste management, hence accepting the null hypothesis. Regardless of the population, communities implemented ESWM accordingly. Communities were aware and knowledgeable of their environmental responsibilities and existing environmental and solid waste policies, making them perform their roles as residents in maintaining a pleasant community.

Table 8. Difference in the extent of implementation of ecological solid waste management when communities are grouped according to population

Variable	U	z	P
Population	23062.500	-1.582	0.114

*Note: *difference is significant when p<0.05*

3.10 Difference in the Extent of Implementation in Terms of Land Area

Table 9 shows that there is a significant difference in the extent of implementation of ecological solid waste management when communities are grouped according to land area. The computed p-value of p=0.001 with z= 3.347 is lesser than the 0.05 level of significance, indicating that there is a highly significant difference in the extent of implementation of ecological solid waste management when communities are grouped according to the land area. This means that the land area of the barangays affects the level of ecological solid waste management, hence rejecting the null hypothesis.

Table 9. Difference in the extent of implementation of ecological solid waste management when communities are grouped according to land area

Variable	U	z	P
Land Area	20571.000*	-3.347	0.001

*Note: *difference is significant when p≤0.05*

3.11 Difference in the Extent of Implementation in terms of Income Classification

Table 10 shows that there is a significant difference in the extent of implementation of ecological solid waste management when communities are grouped according to lower and higher income classification. The computed p-value of p=0.007 with z=2.716 is lesser than the 0.05 level of significance, indicating that there is a highly significant difference in the extent of implementation of ecological solid waste management when communities are grouped according to the income classification. This means that the income classification of the barangays affects the level of ecological solid waste management, hence rejecting the null hypothesis.

Table 10. Difference in the extent of implementation of ecological solid waste management in terms of income classification

Variable	U	z	P
Income classification	24109.000*	-2.716	0.007

*Note: *difference is significant when p≤0.05*

4. CONCLUSION

Solid waste management plays a big role in preserving life and nature. Having clean and organized surroundings helped people avoid diseases, and being knowledgeable about segregation led to a better municipality to stay. The researcher, therefore, concludes that there is a significant difference in the extent of ESWM and the geographical location, land area, and income classification and that the effectiveness of the implementation was affected by these factors. Based on the findings of the study, the researcher recommends that there must be a regular collection of garbage by the assigned unit of the city. There should be regular checking of the barangay as to the implementation of proper solid waste disposal and segregation. There must also be a stricter penalty for those who will not comply with the ordinance. Every household should have at least four garbage cans or bins marked as biodegradable, non-biodegradable, residual waste, and recyclable. A component city should encourage all barangays to attend a seminar/ training about the implementation of ecological waste management.

The great extent of implementation of ESWM activities in the communities in a component city in Negros Occidental, regardless of their geographical location, population, land area, and income, signifies that the communities have law-abiding residents with established and good behavior. However, the gap in the implementation of waste processing and resources recovery activities among the city, barangay, and community implementers needs immediate action to achieve the primary purpose of the ESWM policy. It is best to revisit and review the existing rules and guidelines, especially on waste processing and resource recovery of every barangay. Therefore, a very great extent of awareness and responsibility in implementing the ESWM activities recognizing the existence of waste management policies and strengthening their ESWM behavior is encouraged.

CONSENT

As per international standard or university standard, respondents' written consent has been collected and preserved by the authors.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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