



Waste Characterization, Quantification and Residents' Perception towards Solid Waste Management in Ubay, Bohol

CAROL J. PAYOT*

Bood Elementary School, Ubay, Bohol, Philippines

Email: carolyneteodoro@yahoo.com

REGUCIVILLA A. POBAR

Bohol Island State University, Tagbilaran City, Bohol, Philippines

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Abstract This study aimed to determine the percentage composition of the waste generated, the per capita waste generated per day, perception towards solid waste management practices of the residents of Ubay and the problems encountered in implementing the Solid Waste Management during the year 2015. This study employed descriptive-survey methods in determining the perception of the residents towards solid waste management and the problems encountered. As to the percentage composition, the researcher conducted documentary analysis from the data generated by the Solid Waste Management Office of the Local Government Unit (LGU) of Ubay, Bohol. A first-income class municipality in the island province of Bohol, Philippines. It is in the northeast of the province, and has an area of 335.06 square kilometers (129.37 sq. mi.) with 61 km (38 mi.) of coastline. It has 44 barangays. The Local Government Unit (LGU) of Ubay. One of the mandates of the government is to take care of the environment and protect the residents from various risks of environmental degradation. Findings showed that over fifty percent (50%) of the waste generated were biodegradable (organic) materials. The per capita waste generation was 0.065 kg. Residents had a moderately positive attitude towards solid waste management. The researches recommended that the LGU-Ubay, together with the barangay units, schools, NGO's and other responsible persons, may find more effective and efficient ways of increasing residents' participation level in solid waste management. The Solid Waste Management Board of Ubay may prioritize in strengthening the area of education and training to increase awareness of the residents regarding solid waste management. Further studies may be conducted formulating models that will show the solid waste flow of Ubay, Bohol (or other municipalities). An impact analysis of the strategies employed by municipalities in addressing problems of solid waste may be included.

Keywords attitude, biodegradable waste, Per Capita Waste Generation, perception, waste characterization, waste quantification

INTRODUCTION

In the midst of rapid development and industrialization, proper solid waste management practices play a vital role in maintaining the ecological balance of the country. Solid waste constitutes a major problem in most developing countries. Garbage is becoming a big problem in many places of the world and Ubay is no exception. Ubay, the research locale of this study, is a first-income class municipality in the island province of Bohol, Philippines. It is in the northeast of the province, and has an area of 335.06 square kilometers (129.37 sq. mi.) with 61 km (38 mi.) of coastline. It has 44 barangays. Local Government Unit (LGU) of Ubay. One of the mandates of the government is to take care of the environment and protect the residents from various risks of environmental degradation.

Waste management is one of the most intractable barrier in which administrators and environmental agencies are facing today. Ogwueleka (2009) reported that solid waste management is by far one of the greatest challenges that the country is facing. Human activities generate wastes, and the way these wastes are handled, stored, collected and disposed off can pose risks to the environment and to public health. Problems and issues of Municipal Solid Waste Management (MSWM) are of immediate importance. Ogunyanwo, (2014). This has been acknowledged by most governments, however rapid population growth overwhelms the capacity of most municipal authorities to provide even the most basic services Zurbrugg (2000). Due to their busy schedule, they just want to dispose their waste out the house. Unfortunately, public agents and urban authorities do not have adequate capacity to handle the increasing solid wastes mainly due to limited public budgets. A consequence of failure to remove solid waste are healthy hazards like tetanus, water contamination, sanitary and environmental problems such as pollution. In most developed countries, solid waste is disposed off in sanitary landfills. The buffering capacity of soil makes it possible for landfills to hold waste and prevent pollution of surrounding environment Carlson (1976); as cited by Kaluli (2011). It was provided in Article 11 of the Philippine Constitution, that the State shall protect and advance the right of the people to a balanced and healthful ecology in accord with the rhythm and harmony of nature. Thus, the Philippine government takes into consideration the promulgation of various Presidential Decrees and the enactment of several Republic Acts which took direct action on solid waste management.

The most recent act is the Ecological Solid Waste Management Act of 2000 (RA 9003) which was signed into law on January 26, 2001. The law mandates all, and specifically the local government units (LGUs) “to adopt a systematic, comprehensive and ecological SWM program”. RA 9003 adopts a community-based approach. As an alternative, sanitary landfills should be developed as a final disposal site but they should be operated in accordance with the guidelines presented in the act Bernardo (2013).

OBJECTIVE

This study aimed to assess the solid waste management practices of the residents of Ubay, Bohol, Philippines, in the aspect of waste quantification and characterization, as well as their perception towards their attitude in solid waste management practices during the year 2015.

METHODOLOGY

This study employed descriptive-survey method in determining the perception of the residents towards solid waste management in terms of attitude, and the problems encountered. As to the percentage composition, the researcher conducted documentary analysis from the data generated by Local Government Unit of Ubay, Bohol, Philippines.

The instrument of this study is fivefold which consist the following aspects, namely: Percentage Composition of Waste Generated, Per Capita Waste Generation per Day, Strategies in Reducing Solid Waste, Attitude of the residents towards waste management, and Problems Encountered During the Implementation of Solid Waste Management. This study was conducted in Ubay, Bohol, Philippines. This is a first- class municipality in the northeast of the province of Bohol with an area of 335.06 square kilometers (129.37 sq. mi.) and 61 km (38 mi.) of coastline with 44 barangays.

There were the three hundred sixty four (364) randomly selected respondents who were official residents of nineteen (19) randomly selected barangays of Ubay, Bohol. This number was the result after using Slovin’s formula in determining the appropriate sample size.

RESULTS AND DISCUSSION

Table 1 shows the percentage composition of waste generated per day. It discloses that among the four (4) classifications of solid waste, biodegradable materials generated got the highest weight

composition of 214.29 kg or 52.77%. This is marginally higher than the country's average percentage composition of organic waste (bio-degradable) which 50% (Gapuz, 2011). These wastes include food/kitchen waste (vegetable and fruit residues, fish cleanings and animal carcasses) yard wastes (grass, twigs, and leaves) and agricultural waste.

Table 1 Percentage Composition of Waste Generated Per Day

Classification of waste	Weight composition (kg)	Percentage composition	Sample size	Per capita waste
Biodegradable	214.29	52.77		
Recyclable	82.07	20.21		
Residual	60.99	15.02		
Special	48.73	12.00		
Total	406.08	100.00%	6,258	0.065

The least generated waste was the special waste with 48.73 kg or 12 %. This waste refers to household hazardous wastes. This includes empty cans/containers of paints and thinners, household batteries, spray canisters and the like. Wastes may be hazardous wastes if they exhibit any of the four characteristics of a hazardous waste (ignitability, corrosivity, reactivity, and toxicity) as defined in Article 3 of Chapter 11 of the hazardous waste regulations (Sections 66261.21 to 66261.24). These four characteristics are: Ignitability – Ignitable wastes can create fires under certain conditions, undergo spontaneous combustion, or have a flash point less than 60°C (140°F). Examples include waste oil and used solvents. The characteristic of ignitability is defined in section 66261.21 of the hazardous waste (Gyambrahg, 2016).

This agrees to the study of Oluwaleye (2012) that hazardous wastes which can stem from any of the above sources. Therefore it will not be taken as a part of the classification of wastes by source, rather as a cross-cutting character for all these wastes (UNESCAP, 1993). Moreover, the amount of waste generated in either developed or developing countries depends on the population, degree of urbanization and industrialization, and intensity of agricultural activities.

Typical hazardous waste routinely generated at offshore facilities include waste oil, oil contaminated rags, hydraulic fluids, used batteries, empty paint cans, waste chemicals and used chemical containers, used filters, fluorescent tubes, medical waste and among others. All operators of fixed and mobile units must submit a Waste Management Plan (WMP) showing roles and responsibilities, a list of expected waste streams generated and a Waste Location. (Gyambrahg, 2016) Recycle/ Compost Recycling is a process to convert waste materials into reusable material to prevent waste of potentially useful materials, reduce the consumption of fresh raw materials, reduce energy usage, reduce air pollution (from incineration) and water pollution (from landfilling) by reducing the need for "conventional" waste disposal and lower greenhouse gas emissions as compared to plastic production.

Table 2 Per Capita Waste Generation per Day of Ubay, Bohol

Total waste composition (kg)	Sample size	Per capita waste
406.08	6,258	0.065

Table 2 reflects the per capita waste generation per day of Ubay, Bohol. The per capita waste generation per day was based on the total weight composition (in kilograms) divided by the six thousand two hundred fifty eight (6,258) sample size of the solid waste characterization conducted by the Solid Waste Management Office of the Local Government Unit (LGU) of Ubay, Bohol. As shown in Table 2, total waste composition is 406.08 kg with 6,258 sample size, the per capita waste generated is 0.065. It is below the average waste generation which is 0.3 kg per person per day in the rural areas (Atienza, 2011).

Table 3 manifests the residents' perception towards solid waste management practices. It can be noted that Item number 2 or "Environmental education should be taught in schools" ranked first

among the items. This means that the residents still need to be educated about the environment and how to take care of it.

Table 3 Residents' Perception on their Attitude towards Solid Waste Management Practices (n=364)

Statements	WM	DV	Rank
1. I play an important role in the management of garbage in my community.	5.30	STA	4
2. Environmental education should be taught in schools.	5.57	STA	1
3. The purchase decisions that I make can increase or decrease the amount of garbage.	4.87	MA	9
4. I'm concerned that burning garbage can be bad for my health and...others.	5.10	MA	7
5. People who throw garbage on the streets and in the drains and gullies lack willingness.	4.14	SLA	12
6. The government is doing enough to fix the garbage problems.	4.27	SLA	11
7. Correct garbage management should be taught in schools.	5.12	MA	5.5
8. Other personal issues (like crime, unemployment, and cost of living) are more important to me than a garbage-free community.	4.32	SLA	10
9. Regular collection of garbage is not the only solution to garbage problems.	4.99	MA	8
10. Picking up garbage around my community is my responsibility as a citizen.	5.12	MA	5.5
11. Public education about proper garbage management is one way to fix the garbage crisis.	5.34	STA	3
12. It is very important that the government of Philippines put recycling laws and programs in place.	5.37	STA	2
Composite Mean	4.96	MA	

Legend:

<i>Range</i>	<i>DV</i>	<i>Level of Attitude</i>
5.16 – 6.00 - Strongly Agree (STA)		Highly Positive
4.33 – 5.15 - Moderately Agree (MA)		Moderately Positive
3.50 – 4.32 - Slightly Agree (SLA)		Slightly Positive
2.67 – 3.49 - Slightly Disagree (SLD)		Slightly Negative
1.84 – 2.66 - Moderately Disagree (MD)		Moderately Negative
1.00 – 1.83 - Strongly Disagree (STD)		Highly Negative

Item number 5 “People throw garbage on the streets and in the drains and gullies because of lack of education regarding proper solid waste management practices” obtained the lowest weighted mean of 4.14 (slightly agree). In the absence of a basic facility of collection of waste from source, citizens are prone to dumping waste on the streets, open spaces, drains, and water bodies in the vicinity creating unsanitary conditions (Kumar and Nandini, 2013). This mind set is primarily responsible for the unscientific systems of waste management in the country. The relevance of the study has direct relation to the present environmental issues. There is a global awakening on the issue by the world leaders. Most often the present efforts are disproportionate because all the stakeholders want others to control the contamination.

Citizens assume that waste thrown on the streets would be picked up by the municipality through street sweeping. In this wise, individual's perception will influence the cultural values, responses, and success of the solid waste management system.

Table 4 shows a composite mean of 3.28 that implies very serious problem encountered during the implementation of SWM. In particular, item number 12 “Health problems (presence of dengue)” got the highest weighted mean of 3.54 (very serious). Meaning, there is considerable potential for health hazardous exposure that occurred during the implementation of solid waste management. Therefore, the implementation of SWM takes into consideration through rigid process, monitoring and evaluation in order to lessen uneasiness about the potential health effects of waste management processes, particularly within communities living in the proximity to relevant sites.

On the other hand, item number 7 “Lack of trained personnel” obtained the lowest weighted mean of 3.08 (serious). Without adequately trained personnel for solid waste policy making and implementation, sustainable solid waste management planning and implementation is not realizable.

Table 4 Problems Encountered in the Implementation of Waste Management (N=364)

Statements	WM	DV	Rank
1. Public indifference (public don't care)	3.22	S	9
2. Inefficient collection of garbage	3.25	S	8
3. Lack of financial resources	3.19	S	11.5
4. Lack of authority to make financial decision	3.19	S	11.5
5. Non-operation of good disposal	3.18	S	13
6. Lack of trained personnel	3.08	S	15
7. Lack of enforcement measure and capability	3.16	S	14
8. Foul odor of the dumpsites...	3.36	VS	3
9. Lack of awareness among the people....	3.37	VS	2
10. Lack of training on proper....	3.34	VS	5
11. Health problems (presence of dengue)	3.54	VS	1
12. Lack of collecting vehicle....	3.31	VS	6
13. Open burning	3.35	VS	4
14. Lack of leadership and commitment....	3.26	VS	7
15. Lack of training and non-existence of SWM	3.21	S	10
Composite Mean	3.28	VS	

Legend:

Range		DV/Level of Seriousness
3.26 – 4.00	-	Very Serious (VS)
2.51 – 3.25	-	Serious (S)
1.76 – 2.50	-	Not so Serious (NS)
1.00 – 1.75	-	Not a Problem (NB)

CONCLUSION

There is an increased organic materials generated, with less per capita waste a day. This means that residents had moderately positive attitude towards solid waste management. As the result community awareness and mobilization is important in addressing problem and appropriate plan of action to direct the goal on solid waste management.

RECOMMENDATIONS

It is recommended that the local government unit (LGU), together with the barangay units, schools, NGO's and other responsible persons, may find more effective and efficient ways of increasing residents' participation level in solid waste management. Individual household in barangay level and all other sources such as markets, commercial buildings, institution, schools, hospitals and agricultural industry must implement multi-stream waste-sorting and collection of garbage. The Solid Waste Management Board may prioritize in strengthening the area of education and training to increase awareness of the residents regarding solid waste management. The community shall continue designing and implementing strategies to reduce the generation of waste and to promote awareness among people.

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