Practices, Systems and Issues on Solid Waste Management in Catbalogan City, Philippines

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Abstract

With the use of key informants, questionnaire and interview schedule for 191 respondents in the coastal and island communities in Catbalogan City, the study, conducted in the year 2010, revealed that children were actively involved in domestic and hazardous-related jobs as means to sustain their families' socio-economic survival. The condition of child laborers in the city has worsened in the past six years as shown in the younger average age of the respondents, as well as the reducing income earned from child labor. One of the major probable reasons cited is the dwindling catch from fishing in Samar. The typical child laborer is a male of 14 years, underweight, a 3rd child of a family of 8, a Roman Catholic, and earns an average monthly income of P844.63 by working during daytime, or sometimes at night for 7 hours without parental supervision. The child has an elementary level of education with average scholastic rating. His parents have attained elementary level of education as well, with a father engaged in fishing and a mother as housekeeper. Their family income can hardly provide for even the basic needs of their family. Out-of-school children lose interest and are deprived of schooling as they are more attracted to the income derived from child labor to support their families.

Keywords: child labor, poverty, coastal villages, Samar, Catbalogan

I. INTRODUCTION

One of the most obvious impacts of rapidly increasing urbanization and economic development can be witnessed in the form of heaps of municipal solid waste. According to Imura, et. al. (2005), high population growth and urbanization coupled with rapid economic growth greatly accelerates consumption rates in Asian developing cities. Based on estimates, generation in Asia has reached 1 million tons per day (APO Survey on Solid-Waste Management, 2004–05). In the Philippines, the accumulation of waste can be attributed to population increase, lack of public awareness, poor management and urbanization. According to the Municipal Waste Management Report 2009 conducted by United Nations Environment Programme (UNEP), the annual municipal waste generated in the Philippines have reached 10,539,375 tons. With these, only 28% of these municipal waste are being recycled. The Philippines ranked 7th out of 16 Southeast and East Asian countries in the annual municipal waste generation in tons by weight.

Solid waste management is a challenge or a burden in most countries. It is one of the environmental issues of many developing countries. Improper waste management may result to a strong human health impact, reduction of human productivity and death in many instances. Solid waste management may be defined as the discipline associated with controlling the generation, storage, collection, transfer and transport, processing and disposal of solid waste in a manner that is in accordance with the best principles of health, economics, engineering, conservation, aesthetics, and other environmental conditions (Hwa, 2007). Management of solid waste reduces or eliminates adverse impacts on the environment and human health and supports economic development and improved quality of life. A number of processes are involved in effectively managing waste for a municipality. These include monitoring, collection, transport, processing, recycling and disposal. RA 9003 or the Ecological Solid Management Act defines solid waste "as all discarded household, commercial waste, nonhazardous, institutional and industrial waste, street sweepings, construction debris, agricultural waste and other nonhazardous /non-toxic waste". . It may be categorized according to its origin (domestic, industrial, commercial, construction or institutional); according to its contents (organic material, glass, metal, plastic paper etc); or according to hazard potential (toxic, non-toxin, flammable, radioactive, infectious etc).

The Philippine government has enacted a law in the year 2000 to address the emerging concern of indiscriminate waste disposal. The Philippine Republic Act (RA) 9003 is an act to institutionalize a policy mechanism that shall set guidelines and targets for solid waste disposal and reduction. Further, by virtue of RA 7160 or the Local Government Code of 1991, the cost and operation of waste management were made as the primary responsibility of LGUs. However, thirteen years after the passage of the Ecological Solid Waste Management Act, the intents and purpose of the law have not been fully realized in the Philippines (NDCP Policy Brief, 2013). In fact according to "Socio-economic Report: 2010-2012 of the National Economic Development Authority (NEDA), only 414 or 25.71% out of the 1,610 cities and municipalities completed their Solid Waste Management Plan.

Catbalogan City is the home of 94,317 people (NSO, 2010), known as the "Gateway to Samar Region" due to its geographical location in Eastern Visayas. It is Samar's main commercial, trading, educational, political and financial center. Catbalogan is a new city which attained its cityhood by virtue of Republic Act No. 9391 on March 15, 2007. Managing solid waste has been accorded a low priority in the area mainly because the demand is higher for other public services. These could be seen in the accumulated garbage that can be seen on the streets due to failure of collection of garbage that could be observed in many instances.

Local government is experiencing difficulties in developing management plans due to the lack of Solid Waste Management baseline information and data related to the functional elements of Solid Waste Management. It is essential to know the quantity and composition of Municipal Solid Waste when designing and implementing proper waste management plans that include resource recovery through appropriate methods. This study aimed to assess the current practices, systems, and issues of Solid Waste Management of Catbalogan City, Samar. Specifically, this study seeks to estimate the average per capita of Municipal Solid Waste generation and its total quantity. It also determine the current practices of the Municipal Waste

Management in terms of segregation, collection, treatment and final disposal, and identify and recommend solutions for improving the Solid Waste Management of Catbalogan City.

II. METHODOLOGY

Research Design

The survey covered all 57 barangays of Catbalogan City with a sample size of 1,664 households, 15 institutions and 21 commercial establishments.

1. ***Document reviews.*** Review of pertinent documents was used to obtain a general overview of the solid waste management.

2. ***Direct Observation.*** Actual observations were done to get the actual condition of research subjects. Observation includes recording of the type of waste, waste generated and collection methods. This was undertaken by the researcher and her research assistants. The observed households were taken from the households who participated in the questionnaire survey.

3. ***Interviews.*** Face-to-face interviews with the respondents were conducted. The purpose of the interviews was to verify the information on policy, the legal framework and secondary information. It also seeks to understand existing scenario and explore their views. Interviews were conducted in both Tagalog and waray-waray dialect The respondents were chosen based on the involvement in the Solid Waste Management of Catbalogan City. The author asked the permission of the City Mayor to conduct the study. A descriptive analysis was used to analyze the data gathered.

4. ***Questionnaire Survey.*** A questionnaire was used to acquire information on current practices on solid waste management, determine daily waste generation and waste composition of the residents of Catbalogan City. The developed questionnaire was pre-tested and revised before being administered by the researcher and assistants. Part 1 of the questionnaire consists of demographic information such as age, sex, location, education, income, household size and status of employment. Part 2 of the questionnaire contain questions solid waste management practices to understand waste storage, disposal and recycling. Also included in the questionnaire are the services provided by the local government.

5 ***Estimation of Municipal Solid Waste Generation***

The per capita waste generation was estimated using the following units: For residential waste, kg/capita/day was used. Commercial waste was estimated using kg/x/day where x can be m2 of floor area of commercial establishment or number of employees. Institutional waste was estimated using kg/x/day where x can be the number of students and employees or m2 of the area of a park or public place. Street sweeping waste was estimated using kg/km/day while the total waste was estimated using kg/capita/day. The method used to estimate solid waste quantities was the Materials Mass Balancer Analysis. This method was used to determine the generation and

Table 1.
Category of Solid Waste Sources, Types and Composition

Source	Waste generators	Types of solid wastes
Households	Single and multi-family dwellings	Food wastes, paper, plastics, textiles, leather, yard wastes, metals, ashes, special wastes, wood, metal
Institutional	Schools, hospitals, government offices	Paper, cardboard, plastic, wood, metal, food wastes, glass, hazardous waste
Commercial	Stores, hotels, restaurants, markets	Paper, cardboard, plastic, wood, metal, food wastes, glass, hazardous waste

movement of solid waste with any degree of reliability. A detailed material balance analysis for each generation source, household, commercial and institutional.

The approach to be followed in the preparation of a material mass balance analysis is as follows. First, draw a system boundary around the unit to be studied. The proper selection of the system boundary is important because, in many situations, it will be possible to simplify the mass balance computations. Second, identify all the activities that cross or occur within the boundary and affect the generation of wastes. Third, identify the rate of waste generation associated with each of these activities. Fourth, using appropriate mathematical relationships, determine the distribution is about 40 to 50 percent rubbish (food waste, kitchen waste) 20 to 30 percent wood and plastic products (pallets stumps, branches, forming and framing lumber, treated shingles, bags, cans). 5 to 10 percent miscellaneous wastes (painted or contaminated lumber, metals tar-based products, plaster, glass, white goods, asbestos and other insulation material, and plumbing, heating and electrical parts).

6. ***Solid Waste Sources, Types and Composition***

The solid waste sources, types and composition were categorized into the following:

Waste characterization was conducted consistent with the standard practices for the classification of solid waste at a landfill taking into consideration health and safety. Physical separation and sampling of waste were accomplished as follows:

1. Unload a truckload of wastes in a controlled area away from other operations.

2. Divide the waste load into four.

3. Select one of the quarters and quarter that quarter.

4. Select one of the quartered quarters and separate all of the individual components of the waste into pre-selected components.

5. Place the separated components in a container of known volume and measure the volume and mass of each component. The separated components should be compacted tightly to simulate

the conditions in the storage containers from which they were collected.

6. Determine the percentage of distribution of each component by mass and as discarded density. Typically 100-200 kg (200-400 lb) of waste should be sorted to obtain a representative sample.

This method is a direct waste analysis used to determine the waste characteristics which involve sampling,

sorting and weighing the individual components. According to Bandara et al., (2007), direct waste analysis is time consuming and labor intensive, but it provides reliable data that is detailed, accurate and informative.

III. RESULTS AND DISCUSSIONS

1. Sources of Information

As shown in Table 2, there were a total of 1,740 key informants who were involved in the study. The key informants were interviewed to obtain expert information on solid waste management. The different key informants were purposively selected based on the following criteria: member/ in charge of waste management council, LGU, overall responsibility on waste management and service providers. On the other hand, households were selected through as systematic random sampling to generate a sample of 1,664 households in total. The distribution of the number of households included in the study is shown in Table 5.

Table 2.
Key Informants Interviewed from Subject Areas

Key informants	No. of respondents
City government officials	5
Local government officials (barangay)	30
Solid waste collectors	5
Households	1,664
Commercial establishments	21
Institutions	15
TOTAL	**1,740**

2. Profile of Respondents

The profile of respondents is shown in Table 3. A total of 1,700

Table 3.
Profile of Respondents (questionnaire survey)

Gender	Male 541 (31.8%)	Female 1159 (68.2%)			
Age	21-28 453 (26.6%)	29-55 957 (56.3%)	56-80 290 (17%)		
Education	Primary 739 (43.5%)	Secondary 504 (29.6%)	Tertiary 421 (24.7%)	Graduate 32 (0.00018%)	Post-graduate 4 (0.000023%)
Source of Income	Employed 867 (51.4%)	Self-employed 730 (42.9%)	Unemployed 103 (0.0006%)		
Income	high income (ave. 200,000/mo.) 16 (0.00009%)	middle income (ave. 36,934/mo.) 656 (38.58%)	low income (ave. 9,061/mo.) 1028 (60.46%)		
Occupancy Status	Owners 1,258 (74%)	Tenants 442 (26%)			
Household size	5.2				

respondents were included in the questionnaire survey. Based on the table, majority of the respondents are female with 1,159 or 68.2 % of the total respondents. As to age, majority of the respondents are between ages 29-55 years old with 957 or 56.3% of the respondents followed by 21-28 years of age which pegged at 453 or 26.6% of the respondents. In terms of education, majority of the respondents had primary school education of about 739 (51.4%) and about 504 or 29.6% respondents had secondary level education. Further, 32 of the respondents had graduate level education while 4 of the respondents had post-graduate education. About source of income, majority of the respondents are employed with a total of 867 or 51.4%, about 730 or 42.9% are self-employed while 103 0r 0.0006% are unemployed. In terms of income, majority of the respondents earned low income or having an average income of 9,061 per month which pegged 1028 or 60.46% out of 1,700 respondents. 656 of the respondents had middle income while only 16 or 0.00009% had high income. The occupancy status of the respondents revealed that the majority are home-owners with 1,258 or 78% while only 442 or 26% are tenants. Household size of the respondents pegged at 5.2 which are consistent with the data given by NEDA.

Table 4.
Number of Trucks and Other Equipment for Waste Management in Catbalogan City

Equipment	No. of Units
Compactor Truck	1
Open Dump Truck	4
Payloader	1
Back hoe	1

3. Existing Solid Waste Management System

3.1. Equipment used by local government of Catbalogan City for solid waste management

Table 4 shows the number of trucks and other equipment used by the local government of Catbalogan City for solid waste management.

3.2. Collection of solid wastes

For the urban area or the Poblacion barangays, a hauled container system is used. This is a system where the containers used for the storage of waste remain at the point of generation, except for occasional short trip to the garbage trucks. Below are the phases of collection:

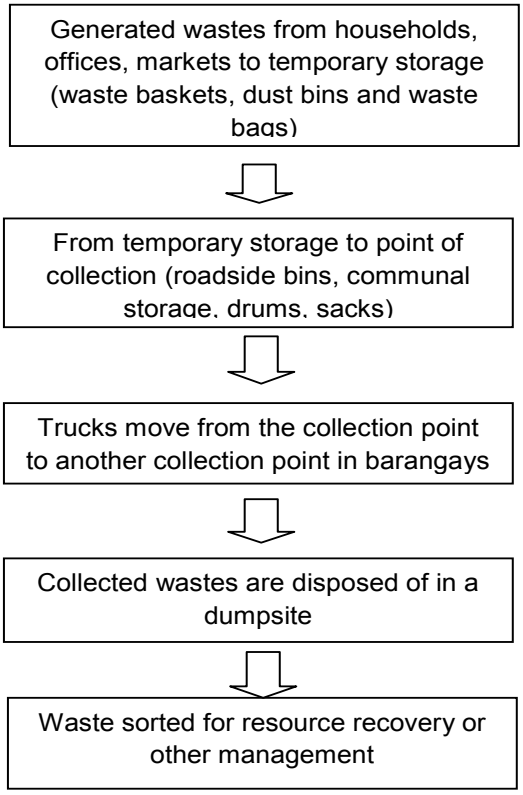

Figure 1. Process flow of solid waste collection in the poblacion of Catbalogan City

4. Solid Waste Generation per Barangay

Waste generation rates are affected by socioeconomic development, degree of industrialization and climate. The greater the economic prosperity and the higher percentage of urban population, the greater the amount of solid waste produced. Table 5 revealed that the average resident waste generated per day was 0.66 kilogram. In a study conducted by USAID in 1999, the Philippines had an estimated waste generation of 0.52 kg per day. The current data shows an increase of 26% in waste generation. Further, as shown in Table 7, Catbalogan City was estimated to generate 77.24 tons of solid waste per day. This amount was produced in residential areas, commercial and institutions. Table 7 shows the amount of solid waste by each category. Further, the data indicated that this is 60% higher than the estimation conducted by Dr. Orale in his study in 2010.

Table 5.
Number of Households and Sampled Households in Catbalogan City

No.	Barangay	No. of House-holds (as of 5/1/10	No. of House-holds Studied	No.	Barangay	No. of House-holds (As of 5/1/10	No of House-holds Studied
1	Albalate	53	5	30	Palanyogon	53	5
2	Bagongon	149	15	31	Pangdan	552	50
3	Bangon	51	5	32	Payao	299	29
4	Basiao	128	12	33	Poblacion 1	265	25
5	Buluan	128	12	34	Poblacion 2	113	10
6	Bunuanan	746	74	35	Poblacion 3	571	51
7	Cabugawan	159	15	36	Poblacion 4	260	25
8	Cagudalo	35	4	37	Poblacion 5	112	11
9	Cagusipan	40	4	38	Poblacion 6	356	35
10	Cagutian	51	5	39	Poblacion 7	260	26
11	Cagutsan	245	24	40	Poblacion 8	226	20
12	Canhawan Guti	71	7	41	Poblacion 9	486	48
13	Canlapwas	2,121	200	42	Poblacion 10	375	37
14	Cawayan	38	4	43	Poblacion 11	244	20
15	Cinco	186	18	44	Poblacion 12	129	12
16	Darahuway Guti	110	11	45	Poblacion 13	756	60
17	Darahuway Dako	140	14	46	Monuz (Pobla-cion 14)	514	48
18	Estaka	197	19	47	Pupua	253	25
19	Guinsurungan	858	80	48	Guindapunan	609	60
20	Iguid	291	20	49	Rama	300	30
21	Lagundi	129	12	50	San Andres	859	25
22	Libas	69	7	51	San Pablo	280	15
23	Lobo	30	3	52	San Roque	230	10
24	Manguehay	38	4	53	San Vicente	161	15
25	Maulong	1,091	100	54	Silanga	568	43
26	Mercedes	1,851	151	55	Totoringan	37	15
27	Mombon	141	14	56	Ibol	90	9
28	New Mahayag	216	21	57	Socorro	271	20
29	Old Mahayag	251	25			**TOTAL**	**1, 664**

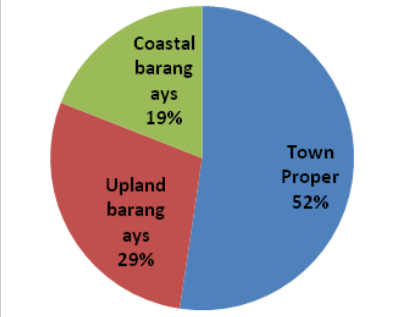

Figure 2. Solid Waste Generation (tons/day)

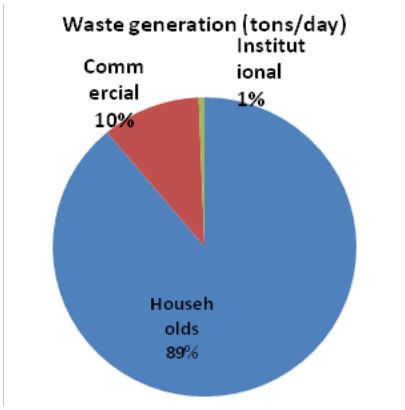

Figure 3. Source of Waste

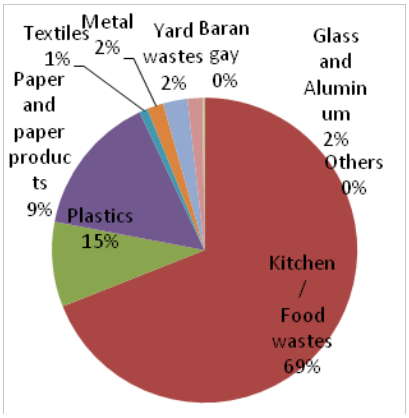

Figure 4. Waste composition in Catbalogan City

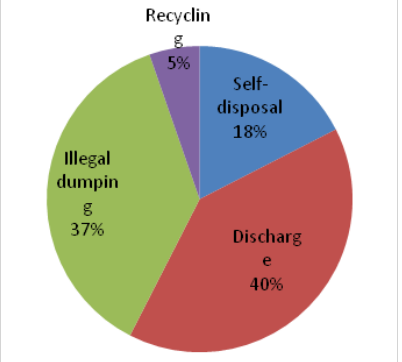

Figure 5. Quantities of Waste disposed of by different methods

5. Types of waste generated in Catbalogan City

Waste composition is influenced by external factors, such as geographical location, the population's standard of living, energy source, and weather. Table 5 shows the waste type used in the study and its composition.

6. Quantities of waste disposed of by different methods

Table 9 shows the quantities of waste disposed of by different methods. Self- disposal refers to burying of waste or burning. The table shows the 13.02 tons of the waste generated are either buried or burned by residents per day. This method is usually used by residents who are far from the collection points and therefore do not bring their waste on the roadside for collection.Discharge, on the other hand, refers to the waste that is handed over to garbage collectors and dump at landfills. As shown in Table 9, 33.9 tons/day of the wastes are discharge waste.

Illegal dumping refers to dumping waste outside the property of the source such as open spaces, rivers, seas, and drains that are prohibited. According to the study, 26.06 tons/day are dumped in the seas or drains. In an interview with a resident along a coastal area, it is just normal among residents to dump their waste in the seas. Another source said that it would be very tasking to bring their wastes in the collection points due to the distance. In the rural areas, solid waste clogs drains and in turn causes floods during heavy rains.

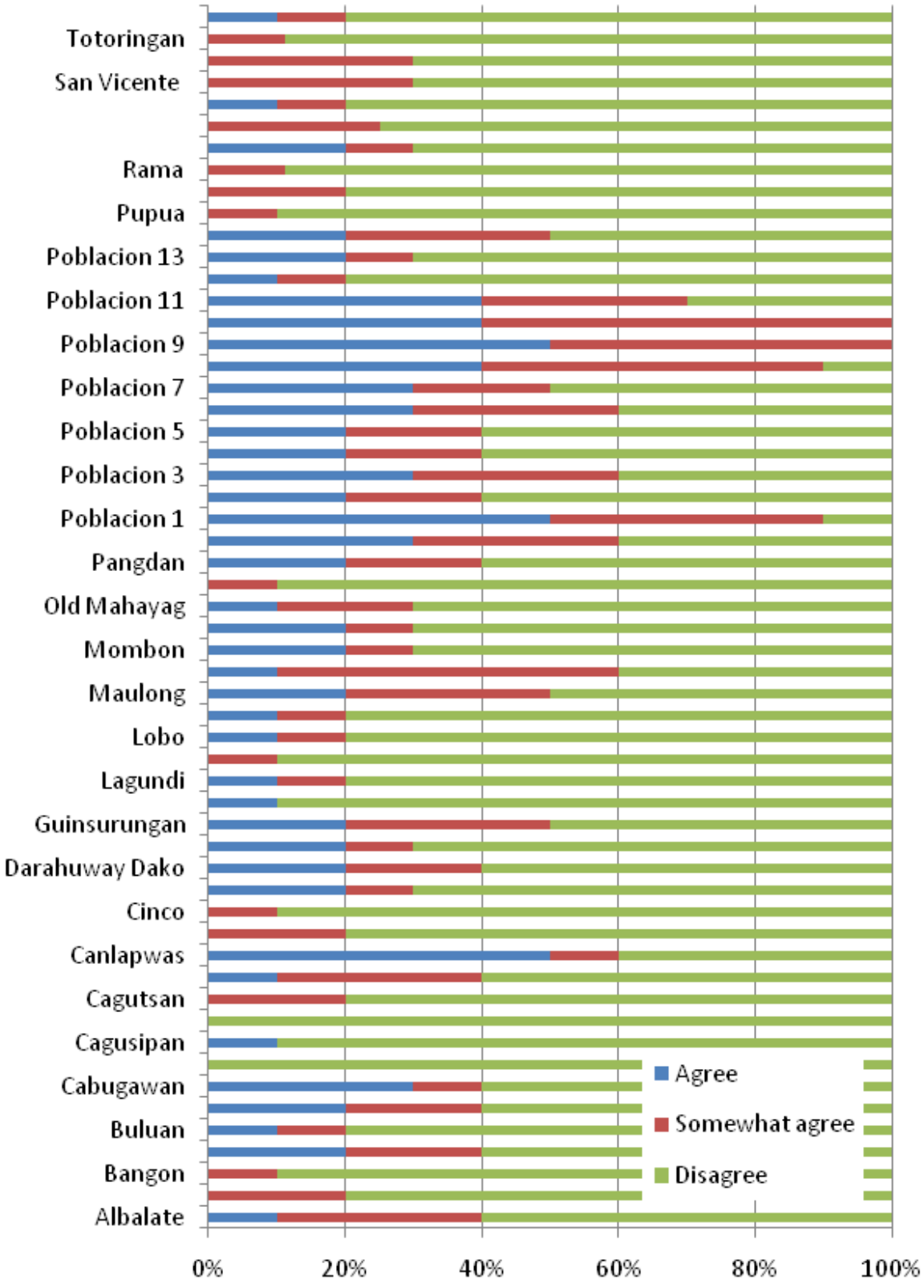

Figure 6. Results of the survey question asking whether respondents were willing to pay for the collection of solid wastes

7. **Percentage composition of waste in Catbalogan City**

   As reflected in Table 8, majority or 69% of the waste composition in Catbalogan City were organic matter or composed of kitchen/ food waste. Household waste contributes a large part to the total amount generated by Catbalogan City. This was followed by plastics with 15% of the total waste composition while paper and paper products pegged at 9%.

   Recycling means reuse of materials such as plastics or bottles. It also refers to selling used materials to a shop or person for reuse or recycling. As shown in Table 9, 4.26 tons/day are being recycled in Catbalogan City.

8. **Results of the survey question asking whether respondents were willing to pay for the collection of solid wastes**

   Figure 6 shows the result of the survey question asking whether respondents were willing to pay for the collection of solid waste from their houses. Results revealed that the majority or 63% of the respondents do not agree while only 15.2% of the respondents agreed to pay for the collection waste. It could be noted that the majority of the respondents who agreed to pay belong to the poblacion or city barangays.

IV. CONCLUSIONS AND RECOMMENDATIONS

The following conclusions were drawn from the study:

1. The facilities used for solid waste management is insufficient for the increasing volume of waste generation in the city.

2. The collectors do not use any protective gears.

3. Open dumping is still used with very low technology sites and is deficiently managed.

4. Catbalogan City was estimated to generate 77.24 tons of solid waste per day. This amount was produced in residential areas, commercial and institutions.

5. The average resident waste generated per day is 0.66 kilogram. In a study conducted by USAID in 1999, the Philippines had an estimated waste generation of 0.52 kg per day. The current data shows an increase of 26% in waste generation.

6. Majority of the waste are composed of kitchen/food waste. This data indicates that these are a potential source for composting since these are biodegradable. Composting of these wastes could reduce the volume of waste that is generated daily. However, if these wastes are not collected, these wastes could be a source of foul smell, ground and water pollution and spread of diseases. Insect and rodent vectors are attracted to these waste and can spread diseases such as cholera and dengue fever.

7. Majority of the residents still use plastics in their packaging materials. The high presence of plastics in the waste could be due to increased used of plastic bottles in soft drinks, shampoos and other goods. Further, the local

government of Catbalogan City has not implemented any policy or ordinance that will limit the use of plastics.

8. The waste components requiring attention in Catbalogan City are food waste and plastics.

9. Residents in the poblacion or city barangays generate two to three times more waste than the interior barangays.

10. Majority of the respondents disagree when asked if they were willing to pay for the efficient collection of solid waste. Further majority of the respondents who were willing to pay belong to the poblacion barangays.

Based on the foregoing conclusions, the following are recommended:

1. The local government of Catbalogan City should seriously undertake material resource recovery and recycling programs. The LGU should also provide technical facilities, intensive awareness campaign and strict implementation of the law.

2. Establish a proper landfill. Proper selection of landfill which should involve an evaluation of engineering, environmental and economic criteria.

3. Provide a collection program that will consider proper planning to include a detailed route configuration with proper routing of collection vehicles and detailed collection schedules

4. Impose waste segregation at source through local ordinances with corresponding fines and penalties.

5. Improve garbage collection services provided by LGU.

6. Promote composting since majority of the solid waste generated are kitchen or food wastes which are biodegradable.

7. Limit the use of plastic bags in groceries and markets through local ordinances and promote the use of reusable bags.

8. Promote the use of appropriate container during collection to facilitate easy handling during collection and maintain good sanitation.

9. Intensive education on proper disposal of waste since the data on illegal dumping is very alarming.

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