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Solid Waste Management and Disaster Preparedness of At-Risk Municipalities of Zamboanga del Norte

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ABSTRACT

The by-product of every human activity is waste. The government initiative of "Tapat ko, linis ko" and "Basura ko, tapon ko" calls for every Filipino to be responsible for managing their solid wastes to prevent disaster properly. This survey aimed to determine the solid waste management and disaster preparedness of at-risk municipalities of Zamboanga del Norte. A descriptive method of research using a questionnaire-checklist was employed to the respondents who were considered by the purposive sampling technique. Data gathered were treated using a frequency count. Findings revealed that household waste makes up the largest bulk of waste. The majority of households have compost pit dug in the backyards as a dumping site, while government sites were used as open dumping areas of wastes generated from business establishments and offices operating in the town commercial areas. The conduct of regular monitoring of garbage disposal, checking of municipal dump site condition, and unclogging of canals littered with dumped garbage is the common solid waste management practices and flash floods disaster preparedness. Their LDRRMC team and volunteers are prepared, equipped with the necessary facilities as well as functional equipment,

and readily on-call in the event natural disaster occurs as perceived by all groups of respondents.

Keywords **—** Waste Disposal, Waste Management Practices, Disaster Prevention

INTRODUCTION

The Philippines, located on both the typhoon belt and the so-called Pacific ring of fire (an area given to geologic fault-lines, earthquakes, and intense volcanic activity), is host to multiple natural hazards that have made it among the most disaster-prone countries in the world. The climate of the Philippines is tropical and is strongly affected by monsoon or rain-bearing winds. On the average, about 20 typhoons occur annually, with June to November averaging approximately 3 typhoons strike per month.

Weather condition nowadays is already unpredictable due to extreme climate change. This phenomenon is attributed by the anthropogenic activities as they go along with the aim of making a living that is more easy, immediate and comfortable. One of the many factors that caused this change is improper waste management. Castillo and Otoma (2013) stated that waste generations by residents in the Philippines, especially in the urban areas, have accelerated recently due to fast pace industrialization, urbanization, and population growth.

Because of the indiscriminating destruction on lives and property and the economic setback natural disasters bring about to its victims, researches focusing on the solid waste management practices of the private citizens and the disaster preparedness of the LDRRMC, with the assistance of the barangay and local government officials need to be conducted. It is hoped that the University, in its extension services would be able to assist the concerned agencies in educating the private citizens as well as putting in place strategies for proper waste disposal to avert flash floods and landslides.

OBJECTIVES OF THE STUDY

This study aimed to determine the following objectives (1) The commercial and household bulk of biodegradable, compostable, reusable wastes, non-recyclable and special waste generation per municipality; (2) How these wastes were managed and disposed of in accordance with the Local Disaster Risk

Reduction and Management Council plans; (3) The conditions of collection, storage, processing, disposal, operating methods, techniques, practices in solid waste management, and (4) The perceived disaster preparedness of at-risk municipalities of Zamboanga del Norte.

Findings will serve as baseline information for the community people as well as a challenge to all concerned local government officials in pursuing and in enhancing what have been started to mitigate or reduce possible destruction to lives and property brought about by natural disasters.

FRAMEWORK

This study is anchored on Republic Act 9003 briefly known as the "Ecological Solid Waste Management Act of 2000, specifically " An Act Providing For An Ecological Solid Waste Management Program, Creating The Necessary Institutional Mechanisms And Incentives, Declaring Certain Acts Prohibited And Providing Penalties, Appropriating Funds, therefore, And For Other Purposes." R.A.9003 provides ten (10) policies intended for systematic, comprehensive and ecological solid waste management, as stipulated in Section 2, on the Declaration of Policies. This law mandates the Local Government Units as primarily responsible for the implementation and enforcement of the provisions of the "Ecological Solid Waste Management Act of 2000 within their respective jurisdictions.

Among other provisions, R A 9003 mandates the organization of a Municipal Waste Management Board that shall prepare, submit and implement a plan for the safe and sanitary management of solid waste generated in areas under their geographic and political coverage. This is composed of one (1) representative of the Sangguniang Bayan, preferably chairpersons of either the Committees on Environment or Health; President of the Association of Barangay Councils in the municipality; Chairperson of the Sangguniang Kabataan Federation; and a representative from non-government organizations whose principal purpose is to promote recycling and the protection of air and water quality.

Smith's (1984) Contingency Rules theory has contributed to the conceptualization of this research. He utilizes the idea of cognitive schemas, expectations about the attributes that a given person or policy will have or expectancies about the consequences of behaving in a particular manner. These schemata function as contingency rules that both shape the way something is viewed and structure behavior. Smith suggests that rules and schemata explain persuasion better than the

traditional concept of attitude. According to Smith's Contingency Rules theory, rules are used to create responses to persuasive messages. Self-evaluative rules are associated with our self-concept and our image. Adaptive rules are those that will apply effectively in a particular situation – the rules most likely to generate a positive outcome. Behavioral contingency rules are contextual. In some situations, certain consequences are considered and certain rules are activated which guide behavior. In other situations, other rules are activated. External threats and rewards are meaningful only if they apply to one's personal goals.

This theory is closely related to the current study since it intends to study the organizational managers leading people to attain organizational goals by applying rules intended to create positive responses which translate into productive results. Through effective management and guidance, people will be guided and be encouraged to practice proper waste management, thus, reducing risks of vulnerable municipalities in the province of Zamboanga del Norte.

The interplay of variables considered in the study is shown in the Venn diagram that follows, in which waste management, the major construction is reflected as the focal point of this study along with the waste management practices classified into dumping in landfills, burning, recycling, segregating and composting. The extent of management of wastes by the local government was assumed to have something to do with the disaster preparedness of the LDRRMC in the municipalities studied.

Figure 1. The Conceptual Framework of the Study

METHODOLOGY

Research Design

A descriptive method of research particularly surveys technique was used to test the claim of this study utilizing a translated researcher-made questionnaire to the 281 LGU officials, business sector and community people of the municipalities under study. It is descriptive in purpose, gathering salient information on the solid waste management and disaster preparedness of at-risk municipalities of Zamboanga del Norte as perceived by the above-mentioned respondents of the study.

Research Site

This study was conducted in the five (5) selected at-risk municipalities of Zamboanga del Norte, namely; Leon B. Postigo, Salug, Liloy, Labason and Gutalac. These municipalities were considered because of its proximity to the university and most of the students of the institution are coming from the above-mentioned municipalities.

Participants

The respondents of the study were the local government unit, business sector and the community people who were considered by purposive sampling technique.

Instrumentation

This study made use of a translated researcher-made questionnaire which was developed based on the salient citations on solid waste management Act of 2000 substantiated with semi-structured interview questions in order to draw out important information which could have been left out in the questionnaire.

The instrument was submitted to the university's research experts who are holders of doctorate degree for its validity. An interview was done right after the respondents had done answering the questionnaire. The reliability test was not computed since the instrument did not contain a rating scale in analyzing the respondents' answers.

RESULTS AND DISCUSSION

Waste Generation and Waste Management Practices

The municipalities surveyed disclosed that the large part of waste generated from the households is biodegradable, particularly food and kitchen wastes, which can slowly be destroyed and broken down into very small parts by natural processes and by bacteria. Other household wastes such as leaves swept from backyards, grass, and manure of domesticated animals, which are all compostable are no longer included in the wastes being disposed of for garbage collection. These are compostable wastes, which are either thrown in the household's compost pit or are just plainly dumped in one place in the backyard, as the common local practice. Reusable wastes such as plastic bottles, tetra pack and other plastic containers and paper products, are usually generated from stores, small and medium enterprise business establishments, and usually from schools and offices. Even if paper and can wastes are reusable, these wastes are not segregated as such. The survey found that Liloy and Labason are the municipalities employing special waste generation from hospitals and clinic, such as PET bottles, syringes, gauze and the like. Accordingly, these wastes are placed in separate containers and disposed of accordingly.

On the average, the bulk of wastes generated from households, office and business establishments is 1-2 kgs a day, but Liloy posted the highest, approximately 5-6 kgs of waste a day. This can be attributed to the number of business establishments, schools, as well as public and private offices operating in Fatima and Baybay Liloy areas, the two commercial areas in town.

The result is similar to the result of the study conducted by Bernardo (2008) which revealed that the households generated an average of 3.2 kg of solid waste per day. The types of wastes commonly generated are food/kitchen wastes, papers, PET bottles, metals, and cans, boxes/cartons, glass bottles, cellophane/plastics, and yard/garden wastes. The respondents segregate their wastes and rely on garbage collection by the government. The collection is done twice daily, except Sundays, and household members bring their garbage when the garbage truck arrives. However, there are those who dump their garbage in non-designated pick-up points, usually in the corner of the street. Additionally, Ultra (2013) in her study also revealed that kitchen wastes ranked first among the solid wastes generated by the sample households of the barangays under study because the majority of them preferred to prepare and cook their food. Kitchen wastes were mostly produced by households with large families and high income while

plastics were with small families having low income. It is evident that the type of waste generated by households differed by size and income.

Table 1. Waste Disposed of Home and Offices

Wastes disposed of homes and offices	A		B		C		D		E		Total	
	f	%	f	%	f	%	f	%	f	%	f	%
Food/kitchen wastes	6	13	10	18	8	14	9	16	7	11	40	14.0
Metals	2	4	2	4	5	8	3	5	2	3	14	5.0
Glass and bottles	5	11	5	9	6	10	5	9	5	7	26	9.0
Clothes/garments/ textiles	1	2	2	4	5	8	2	4	5	7	15	5.0
Liquid wastes			4	7	2	3	2	4	6	9	14	5.0
nylon wastes	7	15	5	9	2	3	1	2	6	9	21	7.0
Papers and other paper products	8	17	7	13	10	17	9	16	10	15	44	16.0
Cans and other steel products	5	11	8	15	9	15	7	13	6	9	35	12.0
Plastic bottles and other plastic containers	9	19	6	11	5	8	8	14	10	15	38	14.0
Positron-emission tomography (PET) bottles					1	2	1	2	3	5	5	2.0
Animal manure					1	2	1	2			2	1.0
Cellophanes & other tetra pack containers			3	6	2	3	1	2	4	6	10	4.0
Others	4	9	2	4	3	5	6	11	2	3	17	6.0
Total	47		54		59		55		66		281	100%

2. In terms of the waste disposal method

In terms of waste disposal, the majority of residents disclosed that they have compost pits dug in their backyards, where household wastes are dumped; yet, others do not practice waste recycling and proper disposal of garbage. This is very evident when one takes a look at drainage canals which are choked up with cellophane and other wastes. Those who answered the questionnaire identified their waste management practice as limited to segregation of waste for the periodic collection by the municipal garbage truck. 7 percent of the respondents reported that they usually burn their household wastes. If and when the burning of wastes, such as paper and other combustible materials becomes a matter of practice, the possibility of it causing fire cannot be discounted. Accordingly,

they pointed out that their municipal landfills are government lands, and at least a kilometer away from populated areas. In terms of the barangay and local waste management educational awareness on waste management policies, 90% of the respondents indicated that they have no idea if there had been activities conducted pertaining to waste management practices. However, 22% of the respondents named the teachers as those who deliver information drive on waste management. This response tends to indicate that the residents' extent of waste management awareness heavily depended on what they may have learned in schools, as well as their actual household practices.

In connection to this findings, the results of the study conducted by Nwofe (2015) indicates that the waste dump sites (designated and non-designated) on the major streets and several open spaces are left unattended for long periods such that the rubbish heaps; encroach on the roads thereby limiting the road users access, generate serious air pollution issues, constitute significant nuisance when blown over by winds, and distorts the aesthetic view of the metropolis. The results also show that the composition of the wastes in the metropolis is heterogeneous because it contains both biodegradable and non-biodegradable materials such as e-waste, plastic, polythene materials, hospital wastes, and hair designers wastes amongst others. His study strongly recommends that Ebonyi State Environmental Protection Agency (EBSEPA) be made to sit up on their functions while Government should strongly consider introducing "waste to energy" as a way of curbing the menace of waste management and simultaneously solving the energy needs of the State.

On the other hand, the results of the study of Okalebo, Opata, & Mwasi (2014) emerged that a centralized neighbourhood form of composting rather than home backyard composting is preferred by the respondents.

Mutavchi (2012) suggested, waste should be seen as goods, and not wasted in landfills. This is in keeping with the recently introduced way of considering solid waste as regular goods, which in the financial term is the Equality Principle. This principle suggests that if wastes are properly recycled, both the environment and the marginalized sector's quality of life will eventually be improved. As such, strong collaboration between the concerned agencies and the community people is of utmost importance. Until such time the culture of proper waste segregation and disposal become ingrained in the community people, littering and clogging of drainage canal will remain to be a common sight in commercial and residential areas. Proper waste management practice potentially averts natural disasters such as epidemic outbreak and flash floods.

Table 2. Waste Disposal Practices of the Respondents in the Selected Municipalities of Zamboanga del Norte

Waste Disposal Practices	A		B		C		D		E		Total	
	f	%	F	%	f	%	F	%	f	%	F	%
Dumping in landfills	7	35	1	7	2	11	3	19	2	13	**15**	**18.0**
Composting	4	20	7	50	4	22	3	19	5	31	**23**	**27.0**
Burning	3	15	2	14	3	17	3	19	2	13	**13**	**15.0**
Segregating	5	25	4	29	6	33	7	43	3	18	**25**	**30.0**
Recycling	1	5			3	17			4	25	**8**	**10.0**
Total	**20**		**14**		**18**		**16**		**16**		**84**	**100%**

3. In terms of solid waste management practices of at-risk municipalities

The commonality on waste management practice tends to be the conduct of the regular municipal monitoring of garbage disposal and the checking of dump site condition, unclogging of the canal, while the enforcement of municipal ordinances pertaining to waste management practices is applied infrequently. The result disclosed that the LDRRMC in each municipality studied tend to help prevent the occurrence of flash floods. This further disclosed that they showed preparedness in times of disaster. Anent to this, Lamond, Bhattacharya, and Bloch (2012) claimed that management of waste was seen to be important to be adopted as part of a wide integrated flood management programme. They added that waste management could be an effective response to flood risk but, in order to remain successful, it requires that sufficient commitment and engagement can be mobilised in the long term.

On the other hand, the study of Azuelo, Barbado, & Reyes (2016) disclosed that the existing SWM strategies with the highest percentages of existence in the twelve (12) municipalities were the provision of a number of trucks in transporting solid wastes and knowledge on waste segregation conducted at every household/establishment. Only availability of technology for composting was considered more effective and can be adopted in all municipalities. They suggested that better solid waste management may be fully attained through the involvement, political will and commitment of the implementers in the implementation of politically passed resolutions and undertaking of their initiatives that will stimulate active participation of the community.

The result of the study conducted by Gequinto (2017) showed that solid waste management practices are implemented to a great extent. Among the practices, waste collection got the highest composite mean particularly on the promotion of 3Rs (reduce, reuse, recycle) in the collection of waste. He added that waste recycling and waste treatment obtained the lowest composite mean. In terms of waste recycling, establishing a partnership with local or private business for a recyclable recovery program was to a moderate extent. Waste treatment particularly neutralization of acid bases was also of moderate extent. He recommended strengthening of public-private partnership (PPP) on the recycling and treatment of wastes.

Table 3. Waste Management Monitoring of the Municipality

Waste Management Monitoring of the Municipality	**A**		**B**		**C**		**D**		**E**		**Total**	
	f	**%**	**f**	**%**	**f**	**%**	**f**	**%**	**f**	**%**	**f**	**%**
1. Conducting educational forum	5	22	5	19	6	21	6	18	7	44	**29**	**23.0**
2.Regular monitoring of garbage disposal	4	18	9	34	7	24	5	15	4	25	**29**	**23.0**
3. Regular checking of dump site condition.	3	14	6	23	6	21	4	12	1	6	**20**	**16.0**
4. Unclogging of drainage	4	18	2	8	3	10	5	15	2	13	**16**	**13.0**
5. Enforcement of municipal ordinance	3	14	2	8	4	14	4	12	1	6	**14**	**11.0**
6. Sanctions for violators of municipal ordinance	3	14	1	4	1	3	3	9			**8**	**6.0**
7. Cleaning or fogging of canals for disease prevention			1	4	1	3	5	15	1	6	**8**	**6.0**
8. Other practices					1	3	1	3			**2**	**2.0**
Total	**22**		**26**		**29**		**33**		**16**		**126**	**100%**

4. Perceived disaster preparedness of at-risk municipalities

The perception of the respondents was also determined on the preparedness of the Local Risk Reduction and Management Council in disaster prevention and response in eventualities of flash flood and fire. The highest percentage of the distribution of respondents, across the five municipalities, declared that the LDRRMC team in their municipalities are ready to respond in the events disasters happen and that to their knowledge, the LDRRMC is equipped with the necessary facilities and that these are ready and functional anytime needed. As Pradhan and Qing (2018) declared that preparedness is the key, and that priority should be accorded to integrating disaster contingency planning in national and city level waste management strategies as well as mainstreaming waste management issues within broader disaster preparedness and response plans and actions.

Results of the study of Shay, Combs, Salvesen, DeTrizio, & Horney (2014) suggest that emergency managers are aware that improved communication with residents could improve preparedness. Residents cite clear priorities in the types of information they want from emergency managers, including where and when to evacuate, how to maintain safe water and sanitation during a disaster, and how to prepare their property for a disaster. Attention should be given to identifying vulnerable groups and providing them with information about preparing disaster plans and related topics.

Table 4. Preparedness of the Local Disaster Risk Reduction and Management Council (LDRRMC)

Preparedness of the LDRRMC	A		B		C		D		E		Total	
	F	%	f	%	F	%	F	%	f	%	F	%
1. Can immediately respond to emergency calls during disaster seven (7) days a week.	5	17	8	29	7	37	10	24	3	14	**33**	**24.0**
2. Equipped with all the necessary facilities such as fire truck, fire extinguisher, rubber boat, speed boat, life jacket, rope, flashlights, personal protective gear, etc.	5	17	10	37	5	26	6	15	2	10	**28**	**20.0**
3. Lacks the necessary facilities for natural and man-made disasters that hinder their response capability	4	14	5	19	1	5	3	7	3	14	**16**	**12.0**
4. Their facilities for rescue are readily available and functional in times of disaster	6	21	2	7	4	21	7	17	5	24	**24**	**18.0**
5. Their facilities and equipment are periodically checked and closely monitored for functionality	2	7	1	4	1	5	5	12	4	19	**13**	**9.0**
6. Some of the facilities and equipment for rescue are not functional.	1	3					1	2	3	14	**5**	**4.0**
7. Visibility of the rescue team in their respective offices is always observed.	5	17	1	4			7	17	1	5	**14**	**10.0**
8. Loose coordination of the different members of the LDRRMC may hinder readiness for prevention and rescue.	1	3			1	5	2	5			**4**	**3.0**
Total	**29**		**27**		**19**		**41**		**21**		**137**	**100%**

CONCLUSIONS

Composting and recycling of wastes are not yet widely practiced by the community people as well as the local government. The conduct of the regular municipal monitoring of garbage disposal, the checking of dump site condition and unclogging of the canal are the common waste management practices and disaster preparedness in case of flash floods by the municipalities studied. The community people in each municipality perceived that their respective LDRRMC's are prepared to respond to the possible occurrence of natural disasters.

TRANSLATIONAL RESEARCH

The findings of this study can be translated into a basis of strengthening the municipal ordinance of creating sanctions or imposing a bigger penalty to violators of RA 9003, known as Ecological Solid Waste Management Act of 2000 for its strict implementation.

RECOMMENDATIONS

In light of the findings, the following recommendations are offered (1) The municipal government should consider allocating budget to fund programs and activities aimed at educating community people on proper waste management practices and recycling of waste materials into saleable and income generating commodities. Facilities and equipment for waste management need to be reassessed and be given priority in the annual procurement plan of the local government; (2) NDRRMC Joint MC No.2014-1 provides for the LDRRM Officer, along with the staff in that office to be responsible for: (1) administration and training; (2) research and planning; and (3) operations and warning. Anent to this, the LDRRMC needs to partner with agencies, preferably tertiary educational institutions for research and extension services along waste disposal, management, disaster mitigation and preparedness; (3) In the same vein, it is also strongly recommended that the LDRRMC partner with the Department of Agriculture for possible funding and extension services for educational programs on composting of biodegradable wastes and organic farming. Also, to make maximum use of recyclable wastes, the LDRRMC, in collaboration with the MSWD are encouraged to organize women's cooperatives and to enable

the women to establish cottage industries and find a market for their recycled products.

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