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Greening of the Solid Waste Management in Batangas City

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Abstract

Management of solid wastes in the Philippines has long been a responsibility of the Local Government Units in the country since the enactment of Republic Act 9003 also known as the Ecological Solid Waste Management Act of 2002. In support to the local government of Batangas City, this study was conducted to propose a plan of action that will enhance the level of implementation of solid waste management in the city, lessen the harmful effects to the environment and health of the people and find solutions to problems encountered in its implementation . The descriptive survey method was used with 204 respondents taken by stratified sampling from selected 69 barangays. A Likert scale instrument was used to measure the level of implementation of solid waste management practices of the residents and the problems encountered by the residents in the implementation of solid waste management practices. A checklist determine the effects of the implementation of solid waste management practices to the environment and health of the people Data analysis made use of frequency distribution, weighted mean and ANOVA. From the findings gathered on the level of implementation of solid waste management and the observed effects to the environment and health of the people including the problems encountered in its implementation, a plan of action was proposed with the hope of enhancing the level of implementation of solid waste management thereby lessening its harmful effects and problems to health and environment.

Keywords: level of implementation /solid waste / solid waste management

1. Introduction

1.1The Problem

The origin and the earliest applications of the study of man's relationship with his environment go back into the mists of time; human beings learned to manage their waste and to recover and reuse certain vitally important raw materials. Historically, the aim of waste management has been to prevent or reduce the impact of waste materials on human health or local amenity. Over the last thirty years, however, the focus of waste management has shifted to reducing the impact of waste on the environment and recovering resources from waste materials. It involves the collection, transport, processing and/or disposal of waste materials. Waste management deals with the whole cycle of generation of wastes, their storage, collection and transport, and their eventual treatment and disposal. Disposal of solid wastes has reached serious proportions and require reliable and appropriate disposal management strategy. The waste elimination capacity of the environment is infinite and nature herself continuously bring them back in various hazardous and toxic forms and elements.

1.2 Importance of the Problem

With rapidly growing population and lack of adequate disposal sites, solid waste has become a major problem for most medium to large-size cities in the Philippines. In recent years, inadequate solid waste management systems have posed serious health risks particularly in densely populated areas. As the Philippines become an industrialized country and its population expands, certain adverse environmental changes that may have serious health consequences remain to be the major environmental health challenge.

The increasing dilemma on waste management in almost all communities across the country due to the uncontrolled population growth, coupled with rapid urbanization and industrialization, have become the primary thrust of the national government (National Solid Waste Management Commission & D.E.N.R., 2004). In addition, the low level of environmental literacy and awareness of the public, partly contributed to the difficulties in implementing and enforcing environmental laws and policy, particularly, laws on cleanliness and sanitation (Jaworski & DENR, 2002). The common observation is that people are apathetic and indifferent toward wastes issues.

This study aims to determine the solid waste management practices in selected communities in Batangas City. Specifically, this study has the following objectives: a) to determine the level of implementation of solid waste management practices in selected communities in Batangas City b) to determine the effects of the implementation of solid waste management practices to the environment and health of the community people c) to investigate the problems encountered by the community people in the implementation of solid waste

management practices d) to determine if there a significant difference in the level of implementation of solid waste management practices among the different communities of Batangas City e) to propose a plan of action that will enhance the level of implementation of solid waste management practices in the selected communities of Batangas City thus greening the waste management in the city.

1.3 Related Literature

Historically, solid waste management did not get any specific attention in policy and legislation except as part of the larger domain of environmental issues on utilization, protection and conservation, management of natural resources and the regulation of behaviour causing negative impact on the environment (Rebullida, 2000). It was provided however 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 take 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 of which is R.A. 9003 or the Ecological Solid Waste Management Act of 2000 which serves as the legal framework for the country's systematic, comprehensive and ecological solid waste management program that shall ensure protection of public health and the environment. It empowers local government units to actively pursue their own SWM systems through preparation of a 10-year SWM plans; creation of a SWM Board responsible for the preparation and implementation of a plan for the safe and sanitary management of solid waste; mandatory segregation of waste; implementation of recycling programs; setting up a Material Recovery Facility; prohibition of open dumpsites as final disposal facility; promoting the establishment of multipurpose environmental cooperatives and associations responsible for undertaking SWM activities or projects; provision of monetary and other rewards and incentives to entities that have undertaken outstanding and innovative SWM programs; encouragement of LGUs to impose fees sufficient to pay the cost of preparing and implementing their SWM plans; creation of a local SWM fund from donations, collection of fines and fees, and allocation from the development fund; and definition of prohibited acts, penalties, suits and other legal actions concerning R.A. 9003. The 10-year SWM plan of an LGU should put emphasis on implementing feasible and environmentally sound techniques of waste minimization such as re-use, recycling, and composting programs. It should identify the amount of landfill and transformation capacity needed for solid waste that cannot be re-used, recycled or composted. The 10-year SWM plan must comply with R.A. 9003 which mandates that 25 percent of all solid waste must be diverted from disposal facilities within a period of five years from the time R.A. 9003 takes effect.

In order to develop a comprehensive provincial SWM plan which will take off from the municipal/city SWM plans, a provincial SWM Board must be created. LGUs should evaluate the roles of the public and private sectors in providing collection services that will conform with the minimum standards and requirements for collection of solid waste. Such standards that must be met are use of protective equipment by collectors, non-spillage of waste within collection vicinity, separate collection schedules for specific types of waste, separate trucks/haulers or compartmentalized collection vehicles.

Recycling programs will be implemented with the support of Department of Trade and Industry (DTI), Department of Agriculture (D.A.), and the Department of the Interior and Local Government (DILG). It is the DTI that is responsible for preparing an inventory of existing markets for processing and purchasing of recyclable materials and implementing a coding system for packaging materials and products to facilitate waste recycling and re-use. It is the responsibility of the D.A. to publish an inventory of existing markets and demand for compost.

Material Recovery Facilities (M.R.F.) should be put up in every barangay or cluster of barangays to receive mixed waste for final sorting, segregation, composting, and recycling before non-recyclable wastes are transferred to a storage or disposal facility. Existing open dumpsites shall be converted into controlled dumpsites within three years from the effectivity date of the law. Sanitary landfills shall be developed and operated as final disposal sites in conformance with the guidelines and criteria provided by the law for the location and establishment of sanitary landfills.

Tax credit and duty exemption to individuals and private organizations who have undertaken outstanding and innovative SWM programs shall be granted. LGUs shall adopt specific revenue-generating measures to ensure the viability of their plans. Allocation from the development fund shall be used for activities that will enhance the SWM programs such as research, information, education and communications, and capability building (Phil-Canada Local Government Support Program, 2003).

Rebullida (2000) cited some problems associated with the traditional solid waste management such as increasing volume of solid wastes, lack of disposal sites, ineffective age-old system of disposal by open dumping and

landfills and environmental degradation and dangers to health. A greater volume of wastes was brought about by an increased population and rise of more businesses and industries. When the government lack funds, it cannot cope with the increasing volume of waste. A related problem is scavenging by poor people whose health are at risk due to the effects of improper waste management.

1.4 Hypotheses and Their Correspondence to Research Design

This study tested the null hypothesis that there is no significant difference in the level of implementation of solid waste management practices among the different communities of Batangas City. This was formulated based on the previous studies about solid waste management and was tested by conducting a qualitative-quantitative research design where community people were interviewed and were asked to answer questionnaires about their implementation of solid waste management.

2. Method

This study involved the residents of the selected communities among the 105 barangays in Batangas City as the respondents. Random sampling using Fish Bowl Technique was used to select the possible communities to be included in the study. Using Slovin Formula, the researchers used sample of 69 barangays with the total number of 204 respondents with a margin of error of 7%. The number of respondents taken from each community was determined by stratified sampling.

Based from a thorough review of the conceptual literature, the researchers constructed a Likert Scale Instrument that measure the level of implementation of solid waste management practices of the community people. The degree by which the practices were implemented was described by this instrument that indicates whether the solid waste management practices were practiced fully, moderately, slightly or never at all.

Another instrument in a form of checklist was constructed by the researchers which determined the positive and negative effects of the implementation of the solid waste management practices to the health and to the environment.

In determining the problems encountered by the residents in the implementation of the said practices, a Likert scale instrument was constructed. The problems were described as encountered at a very intense level, moderate level, minimum level or not a problem.

To ensure that the questionnaires were valid, the researchers consulted experts for face and content validity. Before administering these instruments to the intended respondents, they were tested to some community people who were not included in the study in order to determine the instruments' clarity, accuracy and precision.

In the collection of data for this study, the researchers wrote a letter to the Barangay Chairman of the selected communities to secure permission in administering the instruments in their community. Once the permission was granted, the researchers with the assistance of the barangay officials went from house to house until the required number of respondents was met. The researchers themselves did the administration of the instruments in order to explain to the community people the objective of doing such a survey and to make any clarification regarding the items on the instrument. Retrieval of instruments immediately followed the administration.
In order to describe the data gathered, the following statistical measures were used:

Frequency Distribution. This was used to determine the effects of the implementation of solid waste management practices to the environment and health of the community people. The number of responses for each effect was counted and the percentage was determined.
Weighted Mean. This was used to assess the level of implementation of solid waste management practices and the problems encountered by the community people in the implementation of solid waste management practices. The average of the responses for each item was taken and was interpreted based on the range of the average obtained.

Option	Range	Verbal Interpretation
4	3.50 – 4.00	Fully Practiced, Very Intense Level
3	2.50 – 3.49	Moderately Practiced, Moderate Level
2	1.50 – 2.49	Slightly Practiced, Minimum Level
1	1.00 – 1.49	Not Practiced, Not a Problem

ANOVA (Post Hoc Analysis – Games Howell). This was used to determine the significant difference in the level of implementation of solid waste management practices among the different communities in Batangas

City. The level of implementation of solid waste management practices was compared among the different communities by computing the F- value and comparing it with the tabular value at 0.05 level of significance.

3. Results and Discussion

Table 1. Level of Implementation of Proper Solid Waste Management Practices

Items	Weighted Mean	Verbal Interpretation	Rank
1. Segregation of biodegradable from non-biodegradable wastes	2.63	Moderately Practiced	6
2. Collection of garbage by the municipal truck	2.94	Moderately Practiced	4
3. Selling of bottles, plastics, cans and other scraps to junkshops	3.25	Moderately Practiced	2
4. Reuse of reusable materials	2.72	Moderately Practiced	5
5. Reducing waste generation	2.31	Slightly Practiced	8
6. Recycling	2.18	Slightly Practiced	10
7. Feeding left over foods to pets	3.55	Fully Practiced	1
8. Avoiding the use of toxic and hazardous materials or chemicals	3.11	Moderately Practiced	3
9. Acquisition of sanitary landfill	2.67	Moderately Practiced	7
10. Composting	2.27	Slightly Practiced	9
Composite Mean	2.76	Moderately Practiced	

Table 1 presents the level of implementation of proper SWM practices of the residents. It can be noted from the table that of the proper SWM practices, feeding left over foods to pets is fully practiced by the residents. The residents were observed to practice moderately the selling of bottles, plastics, cans and other scraps to junkshops. Among the ten solid waste management practices, three of them were slightly practiced which are reducing waste generation, composting and recycling.

It could be deduced that the residents lack awareness on these practices and that they are not familiar on the why's and how's of doing such practices. Based on the Solid Waste Hierarchy designed by NWMC & DENR (2004), it is very clear that if we cannot avoid the generation of waste, then try to reduce the volume of waste that is generated. To reduce the volume of waste, try to reuse and recycle materials. If waste production is no longer avoidable then do such treatment such as composting.

Table 2. Level of Implementation of Improper Solid Waste Management Practices

Items	Weighted Mean	Verbal Interpretation	Rank
1. Burning of garbage in every household	2.58	Moderately Practiced	1
2. Dumping garbage in rivers	1.39	Not Practiced	4
3. Paying somebody to throw garbage anywhere far from their residence	1.42	Not Practiced	3
4. Burying hazardous wastes underground	1.52	Slightly Practiced	2
5. Incineration	1.25	Not Practiced	5
Composite Mean	1.63	Slightly Practiced	

Table 2 presents the level of implementation of improper solid waste management. As shown in table 2, burning of garbage in every household is moderately practiced, burying of hazardous wastes underground is slightly practiced while incineration is not practiced.

Burning of garbage in every household is moderately practiced. They are not concerned with the effects of the emitted smoke on the atmosphere and the effects of the particulates coming out from the burning garbage to the health of the people. As Hickman (2000) stated, one of the factors that contribute to solid waste problem is public indifference wherein people do not care on the possible effects of improper solid waste management practices.

The residents practiced slightly the burying of hazardous wastes underground. They never knew that these materials will also create harmful effects though they are buried underground but to a lesser extent only as compared to when they are exposed above the ground together with other solid wastes.

Table 3. Effects of the Implementation of Solid Waste Management Practices to the Environment

Items	Frequency	Percentage (%)
1. Clean and orderly surroundings	172	84.30
2. Fresh air	138	67.60
3. Clean rivers where one may safely take a bath	41	20.10
4. Clean rivers which may serve as source of fresh water fish and shell fish	37	18.10
5. Cold wind	118	57.80
6. Clean water supply that is safe for drinking	145	71.10
7. Fertile soil suitable for a variety of crops	124	60.80
8. Flooding	73	35.80
9. Damage of "marbled" houses due to acid rain	8	3.90
10. Water pollution	36	17.60
11. Death of aquatic animals	29	14.20
12. Destruction of agricultural land	20	9.80
13. Global warming	155	76.00
14. Air Pollution	88	43.10
15. A lot of mosquitoes, cockroaches, houseflies and rats around	129	63.20

It can be gleaned from table 3 that the most observable effect of proper solid waste management to the environment is clean and orderly surroundings. Global warming was observed as an effect of improper solid waste management. Respondents observed global warming as an effect of improper solid waste management. This could be the result of burning garbage in every household which emit too much carbon dioxide in the atmosphere. Carbon dioxide is an air pollutant and together with other greenhouse gases according to SWAT (2004), have an enormous impact on earth's climate.

Table 4. Effects of the Implementation of Solid Waste Management Practices to the Health of the People

Items	Frequency	Percentage (%)
1. Free from epidemic	151	74.00
2. No recorded cases of dysentery, cholera and typhoid fever	123	60.30
3. No recorded cases of H-fever, dengue and malaria	92	45.10
4. No recorded case of lung cancer	92	45.10
5. No recorded case of accidental poisoning due to hazardous chemicals like lead and mercury	145	71.10
6. No recorded case of mental instability due to mercury	151	74.00
7. No recorded case of intestinal diseases due to ingestion of "lead" present in shell fish	138	67.60
8. No recorded case of mental retardation among the newly born infants	138	67.60
9. Increased incidence of morbidity	50	24.50
10.Increased incidence of mortality	44	21.60
11. Increased number of respiratory diseases like colds, cough, bronchitis and pneumonia	91	44.60
12. Spread of sore eyes due to smoke coming from burning garbage	50	24.50
13. Increased number of cases of heart attack and other cardiovascular diseases like hypertension and stroke	75	36.80
14. Decrease in life expectancy	60	29.40
15. Increase in number of patients with anemia	23	11.30
16. Increase in cases of infant morbidity	43	21.10
17. Increase in number of patients with very low resistance to infection	77	37.70
18. Increased number of patients complaining headaches and dizziness due to smoke from burning garbage	60	29.40

Table 4 shows the effects of proper and improper solid waste management to the health of the community people. As shown in table 4, the most observable effects of proper waste management in their community is its being free from epidemic and has no recorded case of mental instability due to mercury. However, improper waste management results to increased number of respiratory diseases possibly because of the smoke coming from the burning of garbage.

Table 5. Problems Encountered by the Community People in the Implementation of Solid Waste Management Practices

Items	Weighted Mean	Verbal Interpretation	Rank
1. Increasing population	2.55	Moderate Level	4
2. Inadequate government policies	2.52	Moderate Level	5
3. Public indifference (Public don't care)	2.56	Moderate Level	2.5
4. Inefficient collection of garbage	2.22	Minimum Level	9
5. Rapid urbanization (ex. Many commercial establishments are developed)	2.25	Minimum Level	8
6. Non-operation of a good disposal facility	2.48	Minimum Level	6
7. Irresponsible government officials	2.31	Minimum Level	7
8. Lack of awareness among the people regarding the effects of solid waste management practices to their health and the environment	2.60	Moderate Level	1
9. Lack of training on proper solid waste management practices	2.56	Moderate Level	2.5
Composite Mean	2.45	Minimum Level	

It can be noted from table 5 that lack of awareness among the people regarding the effects of SWM practices to their health and environment is a problem encountered by the residents at a moderate level. Public indifference and lack of training on proper SWM practices are encountered moderately by the residents. Problems such as irresponsible government officials, rapid urbanization and inefficient collection were encountered by the residents at a minimum level.

Lack of awareness among the people regarding the effects of SWM practices to their health and environment is a problem encountered by the residents at a moderate level. This could be due to insufficient dissemination of information through media or through awareness campaign. R.A. 6969 of 1990 was promulgated to inform and educate the populace regarding the hazards and risks attendant to the disposal of toxic chemicals. Jumalon (2008) cited that one of the factors that influenced the effectiveness of SWM system in a particular city or municipality is proficiency in public communication. Children's exposure to media particularly to radios and television evidently influences the children SWM practices through internalization of jingles, slogans and programs. (Soriano, 2001). In addition to this, Douangchanh (2008) concluded that some of the reasons for the low level of community participation in SWM development are inadequacy of SWM campaigns, SWM workshops and community awareness and education programs, lack of coordination and lack of incentives for people to participate in the activities.

Table 6.Difference of Responses on the Level of Implementation of Solid Waste Management Practices Among the Different Communities in Batangas City

Items	**$F_{computed}$**	**F_{table}**	**Sig.Value**	**Interpretation**
Proper Solid Waste Management Practices	2.647	1.520	0.000	Significant
Improper Solid Waste Management Practices	1.564	1.520	0.042	Significant

$\alpha = 0.05$; df = 29, 174

Table 6 presents the difference on the level of implementation of solid waste management practices among the different communities in Batangas City. It can be gleaned from table that the computed F values of proper and improper solid waste management practices were greater than the tabular value at 0.05 level of significance, thus

the null hypothesis of no significant difference in the level of implementation of solid waste management practices among the different communities in Batangas City is rejected. This means that there is a difference that exists on the level of implementation of solid waste among different communities in Batangas City. Differences were indicated from the result in the Appendix using Post Hoc analysis with the application of Games Howell.

There was a difference that exists on the level of implementation of solid waste among different communities in Batangas City. This could be due to factors such as location, topography, population and possibly to the income of the community. Communities near the city proper might practice segregation of wastes and send their wastes to landfills through the garbage collector or garbage truck coming to their place. However those communities which cannot be reached by garbage truck simply burn their garbage. Some other communities situated near bodies of water dump their garbage in rivers or seas. Densely populated communities generate more solid waste making their SWM practices different from those scarcely populated. The income of a community might affect the SWM practice of the residents because a higher income community can provide the residents with good storage facilities and can facilitate more waste management programs unlike a low income community.

Solid waste management is generally practiced to minimize the impact to the environment and to reduce the effect on the health of the people. The public does not generally realize that their participation in SWM can make a difference. Thus, the proposed plan of action is design to enhance the level of implementation of SWM practices in selected communities in Batangas City.

To encourage residents to do recycling, reducing waste generation and composting, the researchers proposed to conduct a one day seminar, lectures and workshop which will involve government and non-government organizations such as DENR , DEPED and Green Peace organization. Such activity has a desired output of producing environment conscious residents who appreciate the importance of recycling, reducing waste and composting. Sponsoring contests on story writing/ composing poem and songs about recycling in schools and contests on creating recycled products in every community are also suggested. Contests on creating recycled products in every community and opening markets for recycled products will instill the importance of composting on the minds of the residents.

To control improper disposal of garbage by the residents, 2 hours film showing that will depict the harmful effects of improper disposal of garbage to the environment and to the health of the people will be conducted by the Mass Communication students of Lyceum of the Phil. University. The desired output is to lessen frequent burning of garbage and sending hazardous wastes to junkshops instead of burying.

To effectively educate and inform the community about the environmental issues and problems related to improper SWM, media related education programs will be produce by Mass Com students and it is also suggested that Environmental Science students may organize ecology seminar workshops. A continuous conduct of activities throughout (3 days activity every quarter) must be followed to produce environmentally literate community people. The Community Extension Office of L.P.U. may also put up environmental advocacy programs through slogans and jingles or adopting a river-estero program through community outreach program.

Conducting health teaching seminars and extending health services to community people was also suggested. The nursing students and other paramedical courses in cooperation with the COMEX office may conduct such activities continuously at least once a week to produce health conscious community people.

To encourage social acceptance of environmental protection program, giving incentives to residents upon participating in SWM activities was proposed by the researchers. This will produce residents with desirable attitudes and behavior towards SWM.

Based on the findings of the study, the following conclusions are drawn: a) the residents implement proper solid waste management practices such as selling of bottles, plastics, cans and other scraps to junkshops; avoiding the use of toxic and hazardous materials or chemicals; collection of garbage by the municipal truck; reuse of reusable materials; acquisition of sanitary landfill; and segregation of biodegradable from non-biodegradable wastes to a moderate level while improper solid waste management such as burying hazardous wastes underground is slightly practiced b) most of the residents observed the good effects of proper solid waste management such as clean and orderly surroundings, epidemic-free and no recorded case of mental instability due to mercury instead of the harmful effects of improper solid waste management to the environment and to the health of the people c) the residents encountered problems in the implementation of solid waste management such as non-operation of a good disposal facility; irresponsible government officials; rapid urbanization and inefficient collection of garbage to a minimum level only d) different communities in Batangas City differ in the level of implementation of solid waste management practice e) the proposed plan of action may enhance the level of implementation of solid waste management practices in Batangas City.

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