Innovations

Status of Solid Waste Management Implementation in Three Cities Under the Philippines Manila Bay Rehabilitation Project

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Abstract: *The study is descriptive research focused on the solid waste management cluster implementation of the Area Based Management Plan (ABMP) under Manila Bay Rehabilitation Project in key cities in Nueva Ecija to benchmark the current management implementation of ABMP at the local level. This study involved the discussion of the overview of the Area Based Management Plan for Upper Pampanga River under the Manila Bay Rehabilitation Project of the ABMP implementation in the three cities in Nueva Ecija namely: Cabanatuan, Gapan, and San Jose. This study assessed institutional, organizational, and technical aspects of local governance following the ABM plan. The three cities have increasing urbanization due to the development of growth corridors in Central Luzon. The economic growth attributes to the changes in the classification of barangays from rural to urban over the past decade. Cabanatuan City has the most rapid development being the center of business and trade. This conversion indicates an increase in infrastructure and industrial and commercial establishments. This economic growth attracts migration of the working population to the cities. The number of households in cities affects the waste generated per capita per day. The average household family size in the three cities is five (5) persons per household. Cabanatuan City has the highest population compared to the two cities according to the 2015 National Statistics Office. This is comparatively important on the generated wastes. Based on the Waste Characterization Reports of the cities, Cabanatuan City has an average generated waste per capita per day of 0.4 kg followed by San Jose City with 0.3 kg and Gapan City with 0.2 kg. Gapan City has no institutionalized City Environment and Natural Resources Office to enforce the national and local policies. However, Cabanatuan City has a newly institutionalized City Environment and Natural Resources Office that headed the Environmental Protection Division and enforced the local ordinances on solid waste management. San Jose City has an institutionalized system with separate funding allocation and enables to enforcement of local ordinances. The assessment also shows a weak implementation of the technical aspect of solid waste in Gapan compared to Cabanatuan City and San Jose City.*

Keywords*: 1.solid waste management, 2.rehabilitation project, 3.implementation, 4.generated waste, 5.local ordinances, 6.institutionalized system, 7.per capita per day, 8.enforcement of local and national policies, 9.waste characterization*

Introduction

The Philippines has been part of the global economy wherein industrialization, technological advancements, commercialization, and urbanization are the obvious trends of economic development. The said economic developments have been embraced by the government as a way to abate and address poverty and uplift the country's economy. However, this economic path has been coupled with several environmental problems like pollution problems seen and experienced in several urban areas in the country.

In the Philippines, the growth of urban areas has been experienced rapidly from close to 5.2 million in 1948 to about 37 million at the turn of the century (Cariño, 2007). In Central Luzon, urbanization is about 60.51% based on the 2000 NSO Census of Population and Housing.

The above-cited socio-economic trend brings expansion of cities and conversion of rural to urban areas in North and Central Luzon through the development of growth and economic zones by R.A. 7916 of 1995 supported by various laws which institutionalize the Central Luzon Growth Corridors or the so-called W Corridors. The Growth Corridors defines the key growth areas as investment destinations for tourism, industry, and agriculture.

These developments cater to various conversions of lands and infrastructures to facilitate and enhance economic transactions that boost the migration of people from rural areas for livelihood opportunities. However, these developments and migration threaten the existing resources and natural environment of the urban regions. Although this Growth Program integrates environmental consideration and management, local environmental governance and management have to be oversight and empowered to adapt to the rapid encroachment of development and advancements.

Nueva Ecija is part of the corridors where development is encroaching particularly in the key cities of Cabanatuan, Gapan, San Jose City, and other nearby municipalities. Nueva Ecija has a total population of 1.8 million as of 2007 with an annual growth rate of 1.46% over the past seven years (NSO,2007). Cabanatuan City has the highest population in the province with 272,676 people followed by San Jose City with a population of 129,424.

The increasing number of people increases the accumulated waste, specifically in Cabanatuan, San Jose, and Gapan, where accumulated waste is about 300 cu.m., 141.15 cu.m. and 81 cu.m., respectively (PENRO Nueva Ecija, 2010). Based on the submitted Wastes Analysis and Characterization Study (WACS) conducted by the LGUs of the three urban cities stated that the wastes accumulated or generated per capita are 0.4041 kg. (Cabanatuan), 0.3376 kg. (San Jose) and 0.2382 kg. (Gapan) based on their waste analysis and characterization study.

Thus, Nueva Ecija and its key cities are part of the watershed which affects the health of the entire catchment area. We knew that a watershed is a complex system that responds to almost every alteration in any of its components. As a result, the livability of a watershed is compromised and degraded. In support, Laureta (2006) stated that urban cities in Nueva Ecija like Gapan, San Jose, and Cabanatuan have experienced floods due to clogged drainage and improper waste management. The

same event happened in 2009 due to the occurrence of typhoons and clogged waterways and tributaries affecting vast areas in the province, particularly the said urban communities.

Being part of a large watershed that drains to Pampanga River Basin down to Manila Bay, Nueva Ecija's growing urban communities should be sustainably managed not only economically but environmentally.

Objectives of the Study

In general, this descriptive qualitative research assesses the implementation of the solid waste Management program under the Manila Bay Rehabilitation Project in key cities in Nueva Ecija to benchmark the current management implementation of the Area Based Management Plan at the local level.

Specifically, the study aims to:

1. Describe the Manila Bay Rehabilitation Project and Area Based Management Plan (ABMP) of Upper Pampanga River 2014-2018;
2. Assess the status of solid waste management implementation of Gapan City, Cabanatuan City, and San Jose City in three (3) aspects: institutional, organizational, and technical;

Method and Procedures

Exploratory and descriptive research was used to assess and analyzed the current state of solid waste management implementation in three key urban areas in Nueva Ecija.

A structured Questionnaire was prepared for the conduct of key informant interviews with the local government staff and personnel to determine and analyze the current management plans, programs, projects and activities, and other factors considered in EM.

Documents and other data from the concerned local government unit (LGU) were collected and reviewed as support to the key informant interview conducted.

Direct Observation of the researcher was utilized to understand the existing organizational scenario in the urban community. Photo documentation and personal interview were done.

Selective and purposive sampling was done in this research. Nueva Ecija has five cities, however, out of these cities three cities have been selected with evident urbanization and development namely: Gapan City, Cabanatuan City, and San Jose City.

LGUs concerned personnel and staff in urban barangays that were identified as involved in EM were purposively selected in the conduct of the study. Specifically,

Results and Discussions

Institutionalizing the Manila Bay Environmental Agenda

The vast expanse and the surrounding lands of Manila Bay offer historical, cultural, economic, and social significance for Filipinos. Its natural endowments and characteristics, as well as its land and sea attributes, provide food, livelihood, recreation, tourist destinations, and other various uses. The increasing economic importance of the Manila Bay Area contributed to almost two-thirds of the total gross domestic product (GDP) of the country from 2007-2013. (Manila Bay Area Environmental Atlas 2nd Edition dated September 2015)

Despite the various laws enacted defining the tasks and responsibilities of various agencies toward environmental protection, the water of Manila Bay has remained grossly polluted.

On January 29, 1999, respondents, concerned residents of Manila Bay, filed a complaint before the Regional Trial Court (RTC) in Imus, Cavite against several government agencies, on the deteriorating state of Manila Bay.

On September 13, 2002, the RTC rendered a Decision in favor of the respondents. The mandamus agencies then filed for an appeal, to which the Court of Appeals rendered a decision sustaining the RTC's ruling.

The mandamus agencies appealed to the Supreme Court for a final decision. On December 18, 2008, the Supreme Court ordered 13 NGAs to clean up, rehabilitate and preserve Manila Bay thru General Register Nos. 171947-48.

Mandate

The Supreme Court, in recognition of the state's mandate to provide for a balanced and healthful ecology, rendered the writ of Continuing Mandamus on December 18, 2008, directing thirteen (13) agencies to clean up, rehabilitate, and preserve Manila bay, restore and maintain its waters to SB level (Class B sea water per Water Classification Tables under DENR Administrative Order No. 34, Series of 1990 to make them fit for swimming, skin diving and other forms of contact recreation.

The Supreme Court - Manila Bay Advisory Committee (SC-MBAC) was created in October 2009. This is in response to the Supreme Court of the Philippines in verifying the veracity and truthfulness of compliance reports of the thirteen (13) national agencies tasked by the En Banc Decision.

Implementation of OPMBCS

As the lead agency for the En Banc Decision, the Department of Environment and Natural Resources (DENR) was tasked by the SC-MBAC to formulate the Operational Plan for the Manila Bay Coastal Strategy (OPMBCS).

The four (4) major areas of concern on which projects, programs, and activities (PPAs) for the Manila Bay Environmental Agenda will be based. These include four clusters: Liquid Waste Management, Solid Waste Management, Informal Settlers Management, Habitat, and Resource Management.

Technical Working Groups (TWG) were also created to institutionalize the focus areas within the thirteen (13) defendant agencies according to the four clusters identified by the advisory committee. The TWGs composition per cluster is as follows:

Solid Waste Cluster

Chairperson: DILG
Vice Chair: DENR-NSWMC & MMDA
Members: DepEd, DA, DOH, LLDA, PPA, MARINA, PRRC
Phil Coast Guard, League President

Liquid Waste Cluster

Chairperson: DENR-EMB
Vice Chair: MWSS and LWUA, LLDA
Members: DOH, PCG, PNP-Maritime PPA, DA, DILG,
MMDA,DPWH & PPRC

Informal Settlers Cluster

Chairperson: DILG
Vice Chair: MMDA, DPWH & NHA
Members: LLDA, PCUP, Phil Coast Guard, PRRC, PPA,
PNP Maritime, League Presidents

Habitat and Restoration Cluster

Chairperson: DENR-BMB
Vice Chair: DA-BFAR
Members: LLDA, MMDA, DPWH, DILG, MWSS,
LWUA, PRRC, PNP-MG, PCG, DepEd

Institutional Arrangement Cluster DENR-MBCO

The task of the Department of Environment and Natural Resources (DENR) according to the Supreme Court Ruling directed to fully implement its Operational Plan for the Manila Bay Coastal Strategy for the rehabilitation, restoration, and conservation of Manila Bay at the earliest

possible time. Moreover, it is ordered to call regular coordination meetings with concerned government departments and agencies to ensure the successful implementation of the aforesaid plan of action following its indicated completion schedules.

The DENR, as the lead agency, has the responsibility to harmonize all the efforts of all the mandamus agencies through the Manila Bay Coordinating Office.

Based on the Department of Interior and Local Government (DILG) Manila Bay Coastal Rehabilitation Implementing Rules and Regulations, the task of DILG under Supreme Court Ruling of Continuing Mandamus is to monitor all LGUs in Regions III, IV-A, and NCR that are within the Manila Bay watershed area to perform activities in service of six (6) key performance indicators which focuses on the compliance to having hygienic septic tanks and wastewater treatment facilities; the implementation of R.A. Nos. 9003, 9275, and 7279; and conduct information and education campaigns. Furthermore, the concerned Local Government Units were tasked to:

1. Inspect all factories, commercial establishments, and private homes along the banks of the major river systems in their respective areas of jurisdiction and other minor rivers and waterways that discharge water into Manila Bay; and the lands abutting the bay, to determine whether they have wastewater treatment facilities or hygienic septic tank as prescribed by existing laws, ordinances and rules and regulations;

2. Require those non-complying establishments and homes to set up facilities or septic tanks within a reasonable time to prevent industrial wastes, sewage water, and human wastes from flowing into the rivers, waterways, esters, and the Manila Bay, under pain of closure or imposition of fines and other sanctions;

3. Submit to the Supreme Court a 5-Year Action Plan on Compliance of Non-complying Establishments and Homes;

4. Submit to the Supreme Court list of names and addresses or offices of the owners of non-complying establishments and homes; and

5. Submit to the Supreme Court list of names and addresses or offices of informal settlers who, as of Sept. 30, 2010, own or occupy houses, structures, constructions, and other encroachments, along waterways.

Status of Solid Waste Management Implementation

Solid Waste Cluster

1. Institutional and Organizational Aspects

The Mandamus Agencies in the province created a Technical Working Group (TWG) province wherein they involved the local government units in the preparation of plans and provision of technical assistance.

Based on the conducted survey/interview of the OPMBCS-ABMP implementation. The three cities focused on the implementation under the solid waste cluster.

The objective of the Solid Waste Cluster is "LGUs 100% implementing segregation at source and segregated collection with the establishment of MRF per barangay.

Based on the key informant interview conducted and the documents reviewed, San Jose City is the only one with created the City ENRO Office with separate funding and staff for the implementation of solid waste management in 2013. However, the two cities particularly Gapan and Cabanatuan designated City ENR Officers in 2013 who were under the City Planning and Development Office and City Agriculture Office. However, in 2016, the City of Cabanatuan created a position for City ENRO and currently heading the Environmental Protection Division (EPD) while Gapan City still has a designated city ENRO.

The institutionalization of the City ENRO or Environment Office in the local government unit affects the implementation, management, and protection of environmental projects or its key performance indicators (KPIs). Having an Office for Environment at the local level supported with technically capable staff and funding support will at least give emphasis and support to the national agencies in the implementation of the environment local policies and laws passed by the SWMB starting with the preparation and approval of Solid Waste Management Plan.

Although all cities have passed resolutions and ordinances in line with solid waste management, the LGUs failed to accomplish the fundamental need in the SWM which is the preparation of a 10-Year Solid Waste Management Plan at the city level and approval of the proper authority. Plans are the framework and guide in the implementation and operation of various Programs and Projects.

In 2013, the Solid Waste Management Plans of the three cities were all drafted, not following the annotated outline, and not approved by the National Solid Waste Commission (NSWC). Although, the LGUs said that they have started the implementation of the draft SWMP that they have crafted before.

In 2015 with the initiative of the Manila Bay Mandamus Technical Working Group in the province that provides technical assistance and funding for the formulation of the Solid Waste Management Plan and Analysis of the Waste Characterization Study, the three cities were able to craft their draft solid waste management plan. San Jose City is one of the first clusters that have been assisted by the mandamus agencies and the first city in the province that approved SWMP in 2015 by NSWC Resolution No.129 dated March 30, 2015.

Based on the SWMP of the three cities the City Solid Waste Management Board was created as follows under Sec 5 of Rule VI of RA 9003:

The SWMB in 2013 were ineffective although they have a scheduled quarterly meeting due to limited support and prioritization from the local chief executives and officials at both city and barangay levels for the implementation, operation, and management. The limited technical support on the processes and procedures in plan preparation, the establishment of facilities, funding support, linkages, and support from the barangay/community residents affects the environmental management.

The current organizational structure for solid waste management implementation in three Cities is as follows:

Technical Aspect

Regular Clean-up

In CY 2013 according to the key officials and actors, clean-up was being done by the city and barangay local government staff and personnel only and not in a regular manner. Nowadays, clean-up in the community is usually done with the other government agencies, recipients of the Pantawid Pamilya Pangkabuhayan Program (4Ps), barangay officials and workers, and the city personnel and staff. However, this activity was not able to cover all barangays in the city.

In Cabanatuan City, clean-up was scheduled every first Saturday of the month in every barangay per CSWMB Resolution No. 2 "Mandating all eighty-nine (89) barangays to comply with the synchronized continuance of *"Balik Linis Cabanatuan", a clean-up, restoration, and preservation program in every barangay in the city of Cabanatuan and declaring every first (1st) Saturday of every month as the Balik Linis Cabanatuan Day in the City of Cabanatuan."* While San Jose City has a regular clean-up activity every first Friday of the month. Gapan City has no regular clean-up activity in every barangays compared to the two cities.

Segregation at source

Cabanatuan City

Based on the solid waste management plan of Cabanatuan City, the city passed ordinance No. 045 in 2004 on the implementation of solid waste segregation at the source, providing penalties for violation, and creating a special fund for incentives. However, compliance with the segregation at source is a failure. More so, the community also clamor during that time there was no scheduled collection for biodegradable and non-biodegradable.

In 2017 through the implementation of the city's ordinances and yes to segregation, yes collection policy. The households were forced to segregate their wastes (biodegradable and non-biodegradable waste).

Based on the survey conducted with 300 respondents from nine barangays in Cabanatuan City along the main canal of the Pampanga river system and its tributaries, the following wastes management was observed as shown in the figure below:

Figure 6, shows that 96% of the respondents in Cabanatuan City depend on garbage collection and 71% do segregate recyclable waste which is being sold by the households. However,

there are also improper waste disposals done by the respondents such as burning of garbage (34%) and dumping of waste in vacant lots (4%). Others know how to do composting while others just dump their wastes in an open pit in their backyards.

Households also sell their segregated recyclable wastes to the "bakal bote" or informal waste sector while others sell their wastes to the barangay Material Recovery Facility (MRF).

Gapan City

Gapan City passed Resolution No. 50, Series 2010 and City Ordinance No. 15 Series 2010 "an ordinance adopting the Gapan City Solid Waste Management Code and providing a penalty for violation thereof, subject to all laws and existing legal rules and regulations".

This ordinance is not strictly enforced in the community of Gapan. However, some households also recognize the segregation of recyclable wastes and sell them to the informal wastes sector to convert them into cash. Others who have vacant backyards dug pits for their wastes.

Based on the survey conducted with 70 respondents in five barangays of Gapan City along the Penaranda River, the community residents depend on garbage collection in their waste management disposal with an average frequency of 50%. Fifteen percent (15%) responded that they do segregation in their barangay while others do compost (12%). However, some residents dump waste in the river (15%), burned their waste (14%), buried their waste in an open pit (8%), and dumped their waste in vacant lots as shown in figure 7.

San Jose City

San Jose City adopted and implemented the approved Ten Year Solid Waste Management Plan by the National Solid Waste Commission Resolution No. 129, series of 2015. One of the activities is the reduction of waste at source or households and implement the "no segregation, no collection policy".

According to the result of the survey conducted as shown in the figure below with the 200 respondents from the seven (7) barangays/communities in San Jose City along the Talavera River and its tributaries, most of the residents burned their waste (48%) while others buried their wastes in an open pit (29%). Some residents do segregation (21%) and depend on garbage collection (21%). A few (2%) of the respondents compost waste. None of the residents responded that they are dumping wastes into a river or vacant lots.

Segregated Collection

Cabanatuan City

The city of Cabanatuan adopted the "Yes to segregation, Yes to collection" policy in 2016. One of the clamors of the respondents in Cabanatuan City during that time is that the households are segregating their wastes while the collection of biodegradable and non-biodegradable was mixed.

In 2017, the SWMB through EPD gradually started the implementation of the draft 10-year Solid Waste Management Plan, particularly on the strict implementation of the collection policy. The barangay and city haulers of the wastes through a private contractor named "Unicorn Transport Services Inc." were required to have a scheduled collection of waste in 89 urban and rural barangays. The number of hauling days depends on the number of generated wastes per capita in a barangay.

Intensive information campaign/dissemination is conducted in commercial establishments, institutions, and in every barangay in increasing their awareness of the latest scheme being implemented by the City concerning proper waste collection and disposal, routes, and schedule.

The arrival of the garbage truck in a particular area as scheduled is recognized by the sound of a catchy tune. In that way, residents are notified of their arrival. During the initial trips, sanitary inspectors ride on the truck and make announcements through the public address system of the truck, for familiarizing the public with the rules of garbage collection.

The use of a separate truck or hauler for a specific type of waste is being utilized. Specific coded numbered trucks were considered for biodegradable and Non-biodegradables as per scheduled. A total of seventeen (17) dump trucks with a capacity of 8.03 cu.m. and one (1) compactor with a capacity of 5 cu.m. were used to collect the generated wastes in 89 barangays. Ten (10) trucks have three (3) trips per day and five trucks have two (2) trips per day.

Material Recovery Facility

In 2014 based on the DILG data, Cabanatuan City has eleven functional Material Recovery Facility (MRF) wherein one central MRF and ten (10) barangay MRFs. On January 11, 2017, the EDP reported that there are already seventy-five functional MRFs at the barangay level. This simply shows that 84% of the barangays in Cabanatuan City have functional MRF with an increase of 87% compared to 2014 data.

Gapan City

Gapan City passed Resolution No. 50, Series 2010 and City Ordinance No. 15 Series 2010 "an ordinance adopting the Gapan City Solid Waste Management Code and providing a penalty for violation thereof, subject to all laws and existing legal rules and regulations". Chapter IV: Segregation/Sorting-out of Solid Waste Refuse Section 9. All owners, lessees, tenants, and the like of residential houses, commercial establishments, buildings, and other entities within the City of Gapan are required to separate and sort out their solid waste, refuse, and garbage materials into toxic and hazardous waste, bio-degradable and non-biodegradable.

Despite this policy, segregation at the source is still not enforced and followed at the barangay level. Mixed solid waste is brought to drop-off sites and taken by garbage compactor trucks on their respective routes, time, and schedule. After each truck is filled, it will proceed to the disposal site where the solid wastes are unloaded. Typically, waste segregation and reduction occur at the disposal site, scavengers scour the unloaded waste for recyclable waste/salvageable goods, and are sold to junk dealers.

The garbage collection and hauling services are being undertaken by the City government with the use of three (3) units of garbage compactor trucks and three (3) units of dump trucks.

However, informal waste sectors also buy and collect recyclable wastes.

Material Recovery Facilities

Based on the 2014 baseline data of DILG, Gapan City has only one (1) functional Material Recovery Facility (MRF). In 2016, Gapan City has eight barangays with MRFs for composting and recycling out of twenty-three (23) barangays.

San Jose City

San Jose City practices the "no segregation, no collection policy". The city LGU through its City ENRO conduct information campaigns and announcements before the implementation of segregated collection in 2010.

Coded trucks were used in collecting the segregated waste. Recyclable waste was transferred to the forty-five (45) material recovery facilities (MRF) for shredding and compostable materials were transferred to these MRFs for shredding and composting. San Jose City's waste composition is 58.6% biodegradable wastes, 19.57% recyclable wastes, and 13.6% residual wastes. In terms of collection vehicles, the LGU has eleven trucks operated by the city while barangays have one truck and ten tri bikes.

Dumpsites

In the past five years, the waste collected in every barangay by cities was hauled to the open dumpsite sites of every city located as indicated in Table 5.

Cabanatuan City

The city of Cabanatuan has ongoing rehabilitation of the dumpsite at Barangay Valley Cruz (Figure 9). Moreover, the collected segregated wastes from the barangays/households will be transported to the Transfer Station Facility (TSF) located in Barangay San Isidro, Cabanatuan City. Residual waste in the transfer station will then be transported to Clark Integrated Waste Management Facility, a sanitary landfill located at Barangay Kalangitan, Capas, Tarlac, by Metro Clark Waste Management Corporation using two (2) 30-tonner trailer trucks having two (2) trips per day or equivalent to 100-120 metric tons per day.

Gapan City

The City is still utilizing the open Dumpsite as its primary disposal area, located in Barangay Macabaklay, Gapan City, Nueva Ecija. The dumpsite is on a five (5) hectare privately owned lot, approximately fifteen (15) kilometers south-east of City proper as shown in figure no.10.

San Jose City

In San Jose City, the dumpsite is rehabilitated and currently used as a huge composting site for biodegradable wastes from markets and households as shown in figure no.11 . The rehabilitated dumpsite is located at Barangay Malaysian, San Jose City, Nueva Ecija.

Solid Waste Management Cluster Model

The institutional and organizational aspects

Criteria for the assessment of implementation were set as follows based on the existing status of environmental management in the province.

Based on the above graphical presentation, San Jose City has the highest compliance under Manila Bay Rehabilitation Project in line with institutional aspects and organizational aspects. Having a created office at the local level that will enforce the ordinances and policies for environmental management and protection is a great factor to focus on its implementation.

The City of Cabanatuan although they have a separate office, the created City ENRO position was only created last May 2016 and has no separate funding for the Office. However, they were able to start the enforcement of the ordinances in the community particularly the segregation and collection policy. The SWMB also has a regular meeting to create a policy and strategy for the adoption and enforcement of EPD. Gapan has the weakest solid waste institutional management. It has no created item for City ENRO however, they have designated City ENRO. In this case, the funding only depends on the 20% solid waste management fund of the Office of the Mayor. This may lead to the low implementation of local policies on SWMP.

Based on the data and information gathered regarding the implementation of the Area Based Management Plan under the Solid Waste Management Cluster. Gapan has the weakest implementation of SWM. There is low segregation at source but high dependency on collection. Gapan City failed to implement segregation at the source and also failed to do a segregated collection for proper disposal. The dumpsite is still not closed and rehabilitated. However, some barangays established their functional MRFs.

San Jose City strictly imposed its policies on solid waste management. They were able to close their controlled dumpsites and turn them into composting areas. However, the controlled dumpsites must be rehabilitated through ongoing pot closure maintenance of cover, drainage, and vegetation for ten years. The LGU through its City ENRO was able to enforce the no plastic policy, no segregation, no collection policy, and disposal of residual waste to the sanitary landfill service provider. However, this implementation resulted in the traditional way of waste disposal such as burning and open pit dumping and getting away from segregation, and buying sacks/trash bags for segregated collection to reduce and minimize waste generated at the source. It also indicates low compliance on proper waste disposal at the barangay level under the prohibited acts sec.1c. Partially compliance on MRF establishment in barangays.

Cabanatuan City has a weakness in the rehabilitation of its dumpsite at Barangay Valley Cruz. This smokey mountain has been there for more than a decade. Rehabilitation is costly and tedious. Closure and gradual open dumpsite rehabilitation through cut and fill were being done by the personnel and staff of the City Engineering Office. Waste reduction was being enforced but gradually implemented in the community and mandatory collection of segregated wastes is implemented by the private hauler.

The segregated collection is also a weakness since in households the wastes that have to be segregated are biodegradable, non-biodegradable, recyclable, and special waste. Most of the time

during the collection of waste, the biodegradable and non-biodegradable wastes are only classified for collection while recyclable wastes were sold by households to junkshops or informal waste sectors. Special wastes are most of the time mixed with non-biodegradable wastes.

Safety and protection in dealing with solid wastes are often neglected as evidently shown in the three cities. The collectors and personnel dealing with wastes are not equipped with personal protective equipment and paraphernalia such as gloves, boots, and masks for protection in handling wastes. Moreover, vehicles and equipment used in the collection and transportation of waste shall be fabricated, operated, and maintained for the safety and protection of personnel.

Conclusion

Based on the result of the study, the increasing urbanization due to the development of growth corridors in Central Luzon changes the classification of barangays from rural to urban. This conversion indicates an increase in infrastructure and industrial and commercial establishments. This economic growth attracts migration of the working population to the cities as shown in the dependency ratio of 2 dependents for every three (3) working populations. The three cities have an average of 57.7% active population.

Based on the Waste Characterization Reports of the cities, Cabanatuan City has an average generated waste per capita per day of 0.4 kg followed by San Jose City with 0.3 kg and Gapan City with 0.2 kg.

Solid waste management cluster implementation has been the focus of the local government units under the Manila Bay Rehabilitation Project. The result of the assessment shows the status of SWM implementation in the three cities. Gapan City has no institutionalized City ENRO to enforce the national and local policies. However, Cabanatuan City has a newly institutionalized City ENRO who headed the Environmental Protection Division (EDP) and enforced the local ordinances on solid waste management. San Jose City has an institutionalized system with separate funding allocation and enables to enforcement of local ordinances.

Since Gapan has no institutionalized City ENRO, the assessment also shows a weak implementation of the technical aspect of SWM as compared to Cabanatuan City and San Jose City.

Recommendations

Based on the results of the study in line with the implementation of the Area Based Management Plan under the Manila Bay Rehabilitation Project in three cities the following recommendations were as follows:

1. Institutionalization of the City Environment and Natural Resources Officer (City ENRO) to strengthen the enforcement of both national and local policies on environment management particularly solid wastes management and other environmental and social aspects affecting its implementation.
2. Strict enforcement of segregation at source and segregated collection.
3. The OGAs provide continuous technical and financial support/assistance to city and barangay LGUs in the implementation of SWM.

4. Enhance information drive to increase awareness on prohibited acts under RA9003 particularly open burning of solid wastes, causing or permitting the collection of non-segregated or unsorted waste, and dumping of waste matters in public places.
5. Strengthen the information drive and waste diversion of recyclable wastes, special wastes, residual wastes, and biodegradable wastes.
6. Explore partnerships with other recycling companies in various types of wastes (recyclables and special wastes)
7. Review of Solid Waste Management Plan under existing needs and conditions of the SWM implementation in the community
8. Further study and assessment on the changing environment and changing lifestyle affect the types and number of generated wastes.

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Tables

Table 1. The total population in PRB from 1960-2010 based on the National Statistics Data

Year	Population	Increase (%)
1960	608,362	
1970	851,294	40
1980	1,069,409	26
1990	1,312,680	23
2000	1,659,883	26
2006	1,832,645	10
2010	2,023,388	10

Table 2. Institutional and Organizational activities

Activity	2013			2017		
	Cab.	Gapan	San Jose	Cab.	Gapan	San Jose
Passing of Resolution/ Ordinance for creation of City ENRO	0	0	1	1	0	1 (with own funding)
Passing of Resolution/ Ordinance for proper solid waste management	1 (15 ordinances on solid wastes)	1 (2 ordinances on solid waste)	1 (5 ordinances on solid wastes)	1 (2 ordinances on solid waste/ clean-up)	0	1
City 10-year Solid Waste Management Plan approved	0	0	0	0	0	Approved by NSWC
Source: DENR ABMP Monitoring 2013-2017 and 10 year SWMP of Cabanatuan, Gapan and San Jose and Key Informant Interview						

Table 3. The legal basis for the creation of the City SWMB

City	Legal basis
Cabanatuan City	City Ordinance No. 054-2012
Gapan City	Executive Order No. 12, Series of 2013
San Jose City	Executive Order No. 17, Series of 2007

Table 4. Technical activities

Activity	2013			2017		
	Cab.	Gapan	San Jose	Cab.	Gapan	San Jose
Regular Clean-up	0	0	0	1	0	1
Segregation at source	1 (41)	1 (3)	0 (80)	1	0	1
Segregated Collection	0	0	0	1	0	1

Table 5. Status of dumpsites in three Cities in Nueva Ecija

City	Location	Coordinates		Status
		longitude	latitude	
Cabanatuan City	Brgy. Valley Cruz	120^{0}59'35.20" E	15^{0}29'16.91" N	Dumpsite closed and being rehabilitated
Gapan City	Brgy. Macabaklay, Gapan City	121^{0}2'15"E	15^{0}17'19"N	Open Dumpsite
San Jose City	Brgy. Malasin, San Jose City	120^{0}59'51.59"E	15^{0}48'22"N	Rehabilitated and used as composting site

Table 6. Institutional and Organizational Assessment

Institutional and Organizational Assessment	
SWM Local Policies	
1	Approved resolution
2	Passed Ordinance
3	Approved ordinance
4	Ordinance partially enforced
5	Ordinance strictly enforced
SWMP	
1	draft SWMP following the annotated outline submitted to EMB
2	Draft SWMP submitted to NSWC for review and deliberation
3	draft SWMP conditionally approved
4	SWMP approved
5	SWMP implemented
SWMB	
1	Resolution/Ordinance passed
2	SWMB created
3	SWMB inactive
4	SWMB meets twice a year
5	SWMB meets quarterly and calls for a special meeting if needed
Creation of City ENRO/ Local Office for Environment	
1	Passed resolution for the creation of City ENRO

2	Approved resolution for the creation of Office for Environment
3	City ENRO or Office for the environment created with personnel/staff
4	City ENRO or Office for the environment created with funding from devt fund
5	City ENRO or Office for the environment created with its office funding
Note: 5 – highest and 1 - lowest	

Table 7. Technical Aspect on Solid Waste Management Cluster

Technical Aspect on Solid Waste Management Cluster		
segregation at source	% of responses do segregation	With equivalent rating (1-5)
segregated collection	Classification of household waste collected (bio, non-bio, recyclable, and special waste), collected in separated containers and schedule, the vehicle shall be designed considering the road condition, capacity, maintenance of vehicles, fabricated equipment, clean and hygienic collectors	No. of requirements present/total no. of criteria
establishment of materials recovery facility/system	No. barangay / No. barangays with Functional MRF	With equivalent rating (1-5)
Closure of Controlled Disposal Facilities	100% rehabilitated	
Operation/usage of Sanitary Landfill or any approved alternative residual waste processing	MOA with Sanitary Landfill Service Provider/ with existing operational sanitary landfill	

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Figures

Figure 1. Map showing the Manila Bay Area

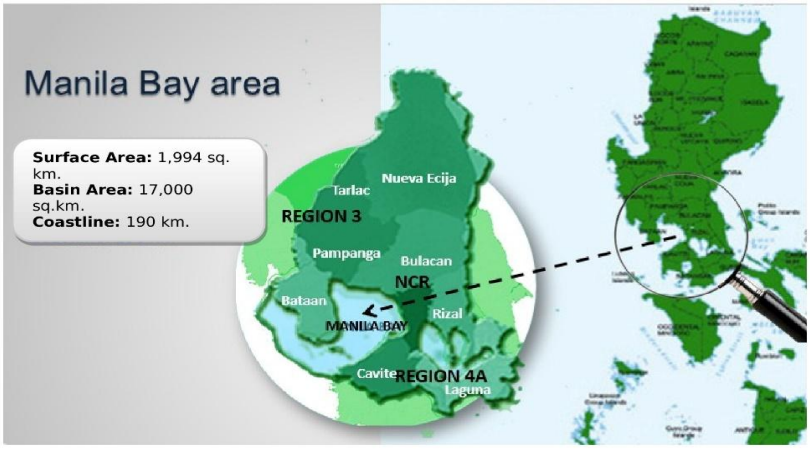
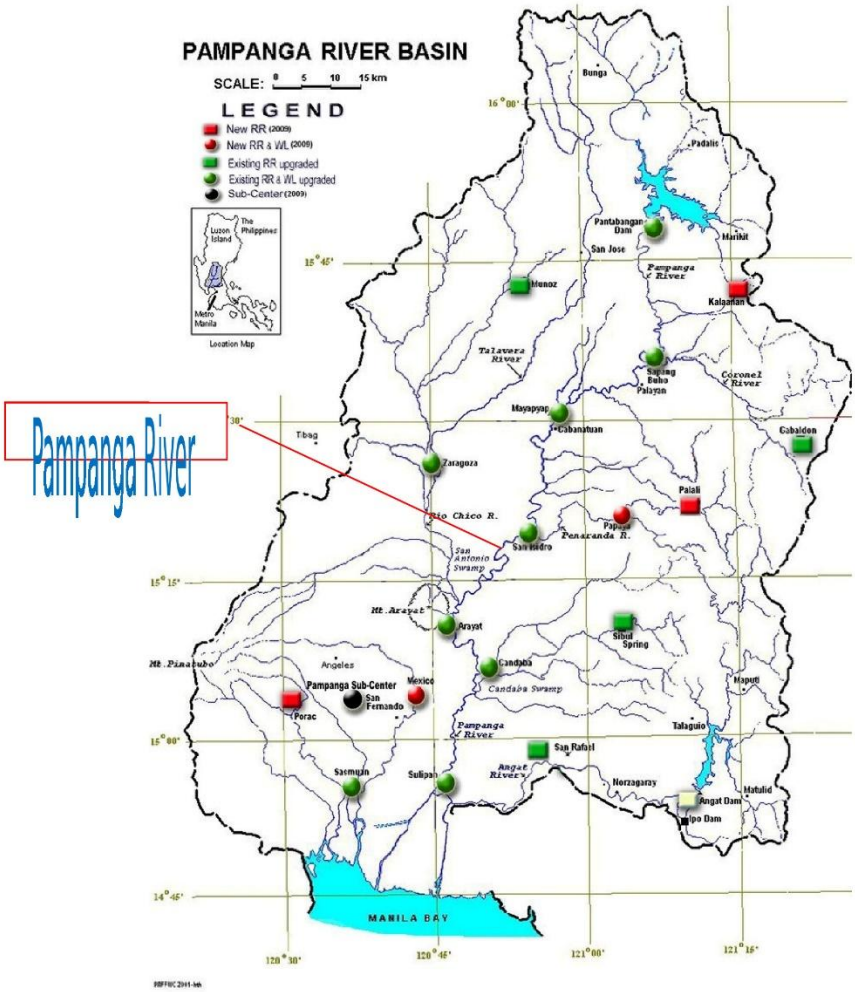


Figure 2. Map showing the area covering Pampanga River Basin draining to Manila Bay based on the PRFFWC, PAGASA, DOST 2011



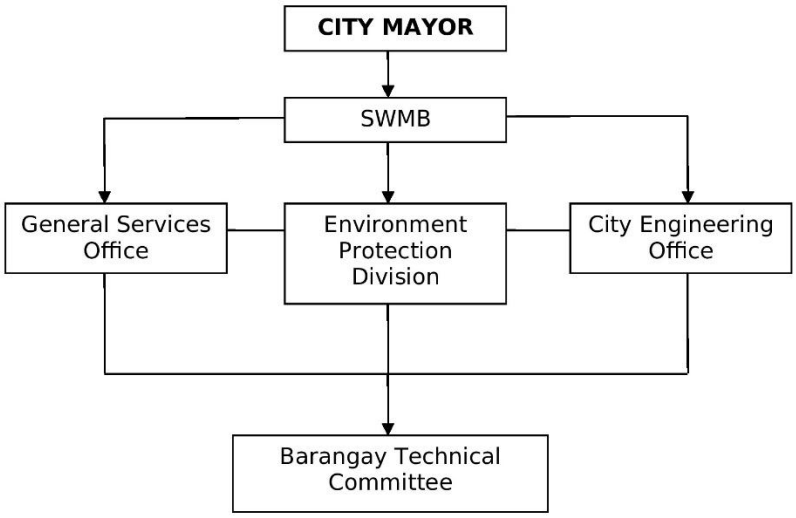


Figure 3. Organization structure on Solid Waste Management implementation in Cabanatuan City

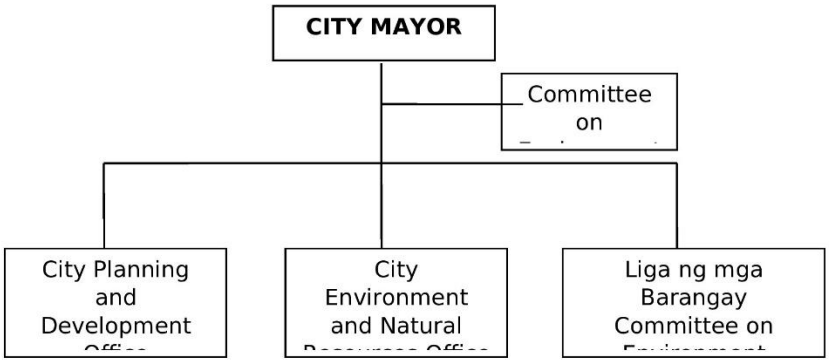


Figure 4. Organization structure on Solid Waste Management implementation in Gapan City

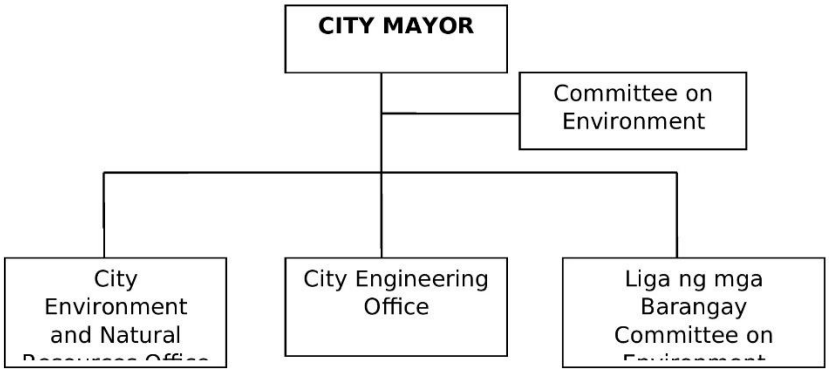


Figure 5. Organization structure on Solid Waste Management implementation in San Jose City

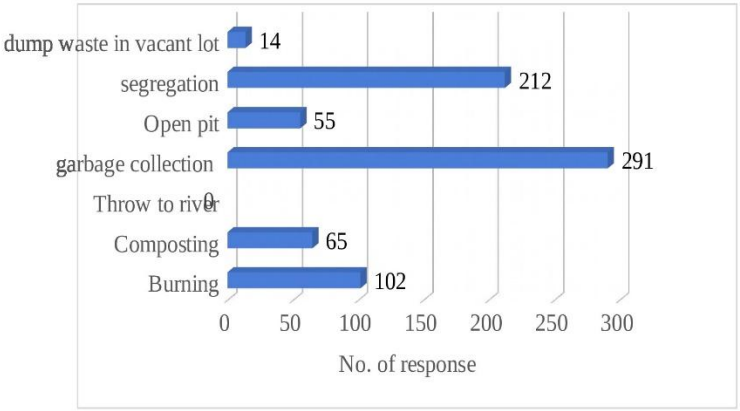


Figure 6 . Solid waste management in the barangay level of Cabanatuan City along river system

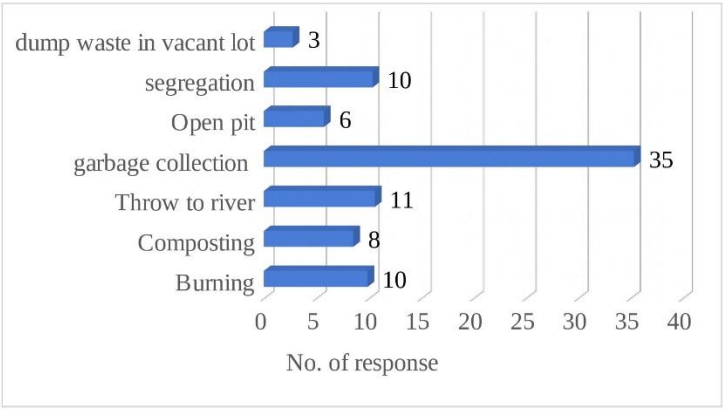


Figure 7.
Solid waste management in the barangay level of Gapan City along river system

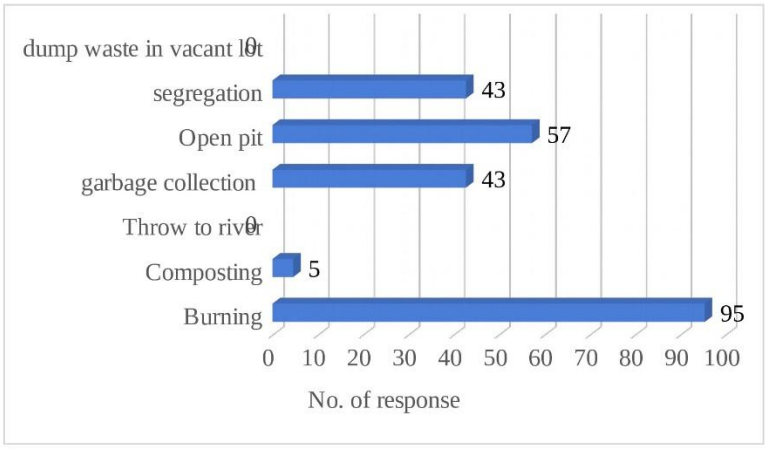


Figure 8. Solid waste management in the barangay level of San Jose City along river system

6


15°17'24"N, 121°2'20"E
accuracy: 11ft
Altitude
350 ft
1/18/2017
3:57 PM
15°17'25"N, 121°2'20"E
accuracy: 11ft
Altitude
354 ft
15°17'19"N, 121°2'15"E
accuracy: 18ft
Altitude
345 ft
1/18/2017
4:05 PM
Gapan Open Dumpsite at Brgy. Macabaclay
Google E
Imagery Date: 3/9/2016
© 2015 Google


15°19'47"N, 120°59'35"E
Altitude
147 m
60
E
2/1/17
12:01 PM

ce of open


Rehabilitated Dumpsite of San Jose City at Barangay Malasin, San Jose City
Google Earth
© 2018 Google
Image © 2017 CNES / Airbus
Imagery Date: 2/1/2017 15°44'23.09" N 120°59'35.94" E elev 117 m eye alt 554 m
85 m
2005

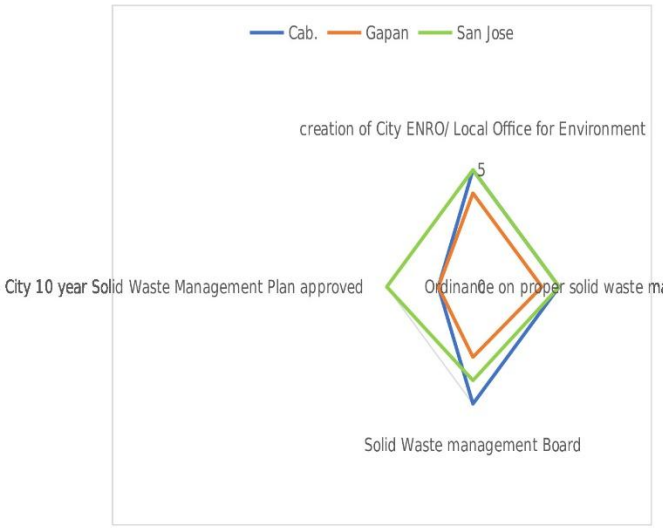


Figure 12.

The assessment status of institutional and organizational aspect on the implementation under solid waste management cluster

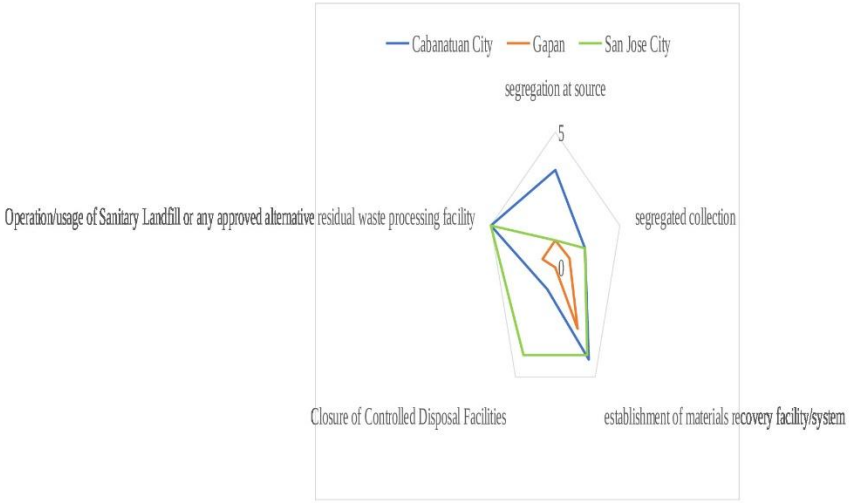


Figure 13. The assessment status of technical aspect on the implementation Under solid waste management cluster