



STREAMLINING WASTE HANDLING APPROACHES TO ZERO WASTE: COMMUNITY-BASED EXPERIENCES IN THE CITY OF SAN FERNANDO, PAMPANGA, PHILIPPINES

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ABSTRACT – Solid waste has been a major problem of a throw-away society. Along with fast-paced lifestyle and commodification of goods and services, is enormous waste disposal. Using the case study design, the objective of this study is to illustrate how waste handling approaches were streamlined to attain zero waste. Methods used were interview and community observation with community experiences as the unit of analysis. Transcripts were analyzed by identifying significant statements, reduced them into codes, identified categories, and eventually creating themes on waste practices. Results show that the zero waste practices in the selected barangays of City of San Fernando anchored on RA 9003, city and barangay ordinances, strictly implemented segregation at source and segregated collection. Moreover, every barangay has functional material recovery facility, and composting area for biodegradables. In conclusion, legal framework, partnership with NGO initiatives, holistic approach in solid waste handling had created a circular waste movement that increase waste diversion at the same time reduce landfill disposal.

Keywords: decentralized and segregated collection, MRF, streamlining, zero waste

INTRODUCTION

Solid waste has existed since the beginning of civilization; and alongside developing communities and expanding population is domestic waste. As can be observed in the field, people take waste for granted hence everything goes straight to the disposal facility and a linear path of extraction, production and disposal resulted in indiscriminate dumping. As this practice continued, household waste would increase due to affluent lifestyle and a throw-away society where plastic, styrofoam and other non-biodegradable packaging accumulate, thus creating uncontrollable waste disposal. Eventually, handling wastes went beyond the carrying capacity of disposal facilities and linear waste stream has become a system in crisis. It became a complex problem in the Philippines thus, a national law on managing solid waste was implemented to curtail the problem (RA 9003).

The new millenium produced scholarly studies on solid waste management across the world and traced the procedures and identified the problems encountered. Omran & Gavrilesu (2008) graphed the roles of actors involved in solid waste practices in Vietnam; these included the household, five types of waste handlers, and each factor involved in the awareness raising, monitoring, and policy planning. The study likewise featured the importance of different actors working hand-in-hand to implement better solid

waste practice. Apostol, Hodoreanu, & Gavrilesco (2007) conducted a research in Romania featuring a system called “separate collection,” which is similar to segregation at source. However, the narrative detailed that it was only a pilot operation due to attitudinal concerns. Findings by Zohoori & Ghani (2017) identified economic and procedural problems in solid waste management based on a comparative study of several low-income countries, which included the high expense of collection of waste, along with the disconcerting issue that unsegregated waste more often end up in dumpsites.

Ejaz & Janjua (2012) described that problems in solid waste management, as studied in Taxila City, Pakistan, was faulty waste handling and open dump-site operations. Firdaus & Ahmad (2010) discovered that there are no official social guidelines in developed countries for the management of solid waste. Residential areas are still common sources of solid waste and landfill use is still the practice.

One of the turning points in the Philippine Solid Waste Management is the crafting of RA 9003, also known as the Ecological Solid Waste Management Act of 2000. It focuses on segregation at source, recovery strategy, materials recovery facility, and strong collaboration of interest groups. The national law was passed in 2000 calling for ecological solid waste management to reduce waste disposal, yet many LGUs are not complying and residents continue to indiscriminately throw waste in open spaces and waterways. Various studies have been undertaken to examine how solid waste is handled in the Philippines. Reyes & Furto (2013) studied the ESWM of Batangas City to propose a plan of action that will improve the SWM level of implementation in the city; whereas Azuelo et al. (2016) assessed SWM in Camarines Norte to determine the existing strategies, effectiveness and possibility of adoption in the municipalities.

Waste actors and the waste stream

The presence of social actors in handling solid waste and institutional arrangement serves as an important anchor in enhancing participation and cooperation among stakeholders in developing LGUs capacity to provide public services on ESWM (Ancog et al., 2012). On the other hand, Paul et al. (2012) studied the positive effects of integrating the waste workers as informal sector into the mainstream solid waste management, providing livelihood and reducing waste in the landfill.

All LGUs are required to comply with RA 9003, but few execute full ESWM while others implement piece-meal approach, limited to Information Education Communication (IEC) campaigns only. LGUs used different titles in crafting their ESWM ordinance to enhance the program as to: ecological solid waste management, integrated solid waste management, solid waste management, and comprehensive solid waste management. All these descriptions used RA 9003 as reference though unfortunately, some were unable to sustain as ESWM practices are co-terminus with the political career of the local executives. The non-sustainability of efforts on solid waste management of some LGUs can also be attributed to the lack of an institutionalized City/Municipal Environment and Natural Resources Office to oversee and monitor proper implementation of RA 9003 and other environmental laws. As per RA 7160, the City ENRO/MENRO department office is optional and not mandatory. Solid waste handling needs strict political network, funds, and community participation. The MRF is an important component of ESWM. It is a temporary storage of recyclables and biodegradable for compost. The MRF intervention in the waste stream diverted recyclable, compostables, and non-biodegradables in the disposal facility, coupled with low hauling services and tipping fees. Eighteen years after the enactment of RA 9003, mishandling of solid waste is still a major problem in the local government. Though the RA 9003 calls for circular waste stream, the framework of cradle to grave in solid waste management still prevails.

Zero Waste Management

Zero Waste as a business model was already used by Dr. Paul Palmer in 1973 for recovering

resources from chemicals (Song 2015). It has been presented as an alternative solution for waste problems in recent decades (Zaman, 2015). In the Zero Waste stream, *waste* is framed as a resource, an environmental good that moves in a circular path, recovered through reuse, recycle, or repair at source. *Zero waste* means “designing and managing products and processes systematically to avoid and eliminate waste, and to recover all resources from the waste stream” (Zero Waste International Alliance, 2009). The framework is an industrial model addressing the product design as not to waste in the process of production. In addition, businesses and communities that divert 90% of all discarded materials from landfills incinerators, and the environment would be considered zero waste businesses and communities (ZWIA.org).

According to Zaman and Lehmann (2011), the key drivers of a Zero Waste city are based on short-term and long-term implementation strategies. Awareness and education, behavior change and systems thinking are long-term strategies, whereas innovative industrial design, legislation and 100% recycling are the short-term strategies to implement in a city. All these drivers facilitate the conversion of solid waste into resource, where waste is recirculated in the market. By recirculating, waste is avoided from the disposal facility and moves in circular pattern.

The waste stream conversion requires a series of holistic strategies based on key development principles. Education and research are placed on top of the Zero Waste hierarchy. Without proper environmental awareness and advanced research on waste, it would not be possible to achieve zero waste goals. Sustainable consumption and behavior are placed second in the Zero Waste hierarchy. As the current trend of consumption is unsustainable and cannot be continued forever, it is crucial to understand the reality and act accordingly. It is important to have specific zero depletion legislation and incentive policies, as part of the strict environmental legislations. Finally, a new system thinking approach and innovative technologies are needed to transform current cities into zero waste cities.

As a qualitative study, this paper intends to illustrate how the CSFP streamlined solid waste handling management in the barangay level. The barangay is the lowest political unit in the Philippines. Specifically, other issues raised related to streamlining include determining the following: (a) institutional arrangements, (b) processes in streamlining and (c) functional material recovery facility. The goal of the study is to craft a model to be used by local leaders in promoting and enhancing zero waste practices.

METHODS

The case study design was used to achieve the overall intent of the paper. The issue on waste handling approaches is how segregation at source was accepted by the local people, how decentralized collection was implemented and sustainability of material recovery facility. Case study is the study of an issue through one or more cases in a setting or context (Creswell, 2009). Apart from the interview, the study conducted a review of secondary data and community observations.

Selection and Study site

The locus of the paper are the barangays in the City San Fernando, Pampanga (CSFP), located in the corridor growth area of Central Luzon (see figure 1). The barangays located at the crossroad of development, is an access spine connecting several cities, municipalities and provinces in Central Luzon.



Figure 1. Encircled map of the City of San Fernando, Pampanga as study site (Source: Google Maps, 2019).

Ten barangays from CSFP were chosen based on (1) proximity to the City Hall; (2) barangays with functional MRFs; (3) barangays with the most number of MRFs (4) Barangays with the least number of MRFs.

The following barangays (see table 1) are: Alasas, Maimpis, Del Pilar, San Agustin, Dela Paz Norte, Telabastagan, Sta. Teresita, San Isidro, Malpitic, Malino and Maimpis.

Table 1. 2018 Profile of the selected barangays in CSFP (n=10).

Barangay	Area Size	Barangay with least number of MRF	Barangay with the most number of MRF	Number of functional MRF in the barangay
Alasas	127			5
Maimpis	254			5
Del Pilar	71			5
San Agustin	295		Yes	7
Dela Paz Norte	170			4
Telabastagan	191		Yes	7
Sta. Teresita	81	Yes		1
San Isidro	140			3
Malpitic	131			2
Malino	168	Yes		1
Maimpis	254	Yes		1

(Source: CENRO)

Selection of key informants are the Barangay Chairmen of the ten selected locale. Profile of the Chairmen includes age, gender and political experience as Chairman.

Table 2. Demographic profile of the participants (n=10).

Profile	Frequency	%
Age		
25 – 40	1	10%
41- 60	9	90
Gender		
Female	0	000%
Male	10	100%
Political Experience as Chairman		
1 - 3 (one term)	6	60
1 – 6 (two terms)	2	20
1 - 9 up (three terms – up)	2	20

The key informants are the current elected Barangay Chairmen who are hands-on in managing the community-based decentralized waste collection and MRF.

Data Gathering Procedure

Data gathering was conducted before the local election in 2018. The interview was aided by guide questions and field notes that later translated into field texts. Qualitative data were gathered from the interviews of the 10 barangay chairmen. Apart from interviews, there are community observations of decentralized collection processes, the MRF (eco-sheds and composting area); type of collection vehicle; different *puroks*¹; city transfer station and city composting center. Field notes and photographs aided the community observations, while interview with the Chairmen was aided by guide questions.

All key informants received written and verbal information as to aims, procedures and extent of participation in the study. Ethical considerations covered permission from CENRO to conduct interviews with the barangay-based solid waste handling and informed consent approval from the concerned Chairmen.

Mode of Analysis

Interview data were transcribed, reviewed and processed through MaxQDA, a software to facilitate clustering of issues. Transcripts were reduced to codes and categorized. Categories were analyzed and themes were crafted. The findings were validated by presenting the result of the study to CENRO, Pampanga.

RESULTS

A. Institutional Arrangements

I. CENRO

Streamlining begins with the creation of the City Environmental Natural Resource Office to oversee the collection and disposal practices of the barangay. CENRO was anchored in SP Ordinance No. 2008 021, an ordinance enacting the 2008 environmental code of the city of San Fernando, Pampanga addressing the rapidly increasing environmental concerns of the city.

Solid waste management division is one of the components of CENRO, with the function of developing (1) plans and programs for an ecological solid waste management plan of the city; (2) plans and programs for the greening of the community; (3) greenbelts and parks within the barangay or strategic places within the territorial jurisdiction of the city; (4) environmentally sound methods that minimize the use of resources and encourage resources and recovery.

More importantly, CENRO promoted greater public participation, through public information and education campaign on the protection, preservation, conservation, and care for the environment. In collaboration with the City government, CENRO initiated the information drive on plastic-free ordinance and waterways clean-up drive. The initiatives encourage grassroots participation towards community environmental development. By barangay participation, residents are able to develop a greater sense of community, promote the value of waste as an environmental good, and value the MRF as a community asset while giving importance to the ecosystem services of the waterways.

The City plastic free city ordinance was strictly implemented by CENRO in collaboration with the Barangay Office. As plastic use is not allowed, there was reduction in the generation and disposal of plastic packaging. CENRO and the barangays actively implemented waterways cleaning cleanliness and sanitation on transboundary waterways.

CSFP uses a city composter in reducing solid waste in. Biodegradables are processed in the composter into soil enhancer. The composter diverts the waste disposed in the transfer station and soil enhancer is beneficial to the local residents and farmers. Some compost products are sold to farmers at Php 360.00 per 40-kilogram sack (\$18.980 at 52.00 = \$1). Others are donated to barangay farmers through the greening program of the City in coordination with the City Agriculture and Veterinary Office (CAVO) and the City Health Office (CHO). According to CENRO, the soil enhancer has an average rate of 6% diversion rate (interview with CENRO staff).

The city composting area is located at the Motorpool Compound, City Hall Extension, Del Pilar, CSFP being managed by CENRO. Its floor area is 900 sq.m. and the capacity of the composting equipment is 1 ton per day. Biodegradables are transferred to the city composter from the two public markets and a city slaughterhouse. The composting center produces an average of 400 kilos of compost per week from an average of 11, 269 kilos of biodegradable wastes received per week. Most organic waste is being managed at the household and barangay levels.

Aside from the composter, CSFP has a city transfer station located in Barangay Lara that sits on a six-hectare lot. The barangays normally bring their residuals to CTS every Monday-Wednesday-Friday, while the big ones, like Dolores, Sindalan, and San Agustin do it in a daily basis (interview with CENRO Officer). The Tuesday-Thursday schedule is for maintenance and Saturday is limited to agricultural waste. Residuals from the barangays such as plastics, styro and diapers and sanitary pads are placed in sacks, weighed per kilo. These sacks of residuals are later transferred to the landfill for final disposal.

An average of 65.68 tons per day (2018) from the CTS of CSFP is brought to the sanitary landfill of Metro Clark Waste Management Corporation in Kalangitan, Capaz, Tarlac. The MCWMCL is a private landfill where several local government units are finally disposing residuals, as coordinated by the Pampanga Provincial Government thru its active Provincial Solid Waste Management Board.

2. NGO – LGU Partnership between Mother Earth Foundation (MEF) and CSFP

Streamlining in waste handling at the community level was facilitated through the strong partnership between the City government and Mother Earth Foundation (MEF) that officially began in September 2013 through a project entitled “City of San Fernando Ecological Solid Waste Management Program – Phase 2.” MEF is a non-government organization advocating for community-based solid waste management. The partnership intends to provide IEC campaigns on Eco-Waste Management (MOU between MEF and CSFP, 2013). Seminars and workshops were conducted to provide low cost, local, and low-tech approaches and solutions (ESWM program for CSFP). This partnership is an important component of the solid waste practices in CSFP as it provides a holistic approach in managing household wastes. The partnership of MEF with the barangay could be summarized in 10-step holistic activities (see Figure 2).

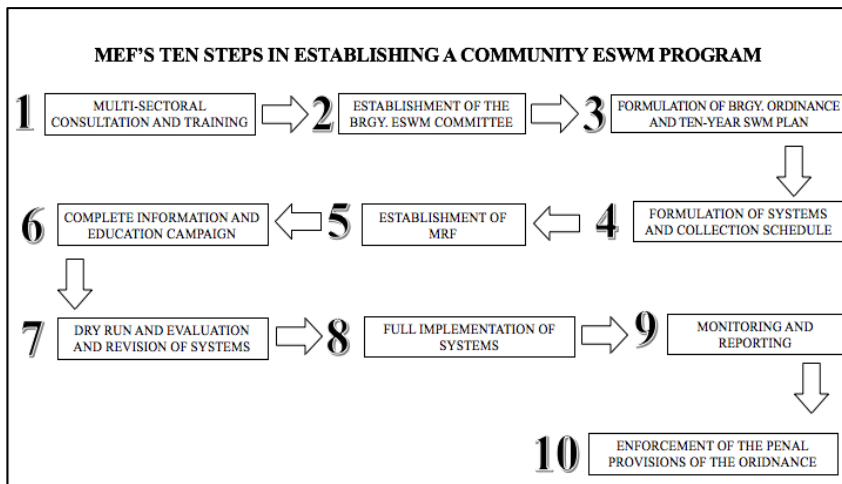


Figure 2. MEF 10-step holistic approach (Source: MEF).

The goal of ecological solid waste management is to divert waste from the disposal facility resulting to ninety percent (90%) waste diversion to be considered as zero waste. Thus, the MEF and CSFP collaboration is to attain the highest divert rate by strengthening the “Ten Step” community ESWM

program. The first step is the creation of a group of stakeholders that serves for multi-sectoral consultations vis-a-vis training of members. The second step is the formation of barangay ESWM committee that would oversee barangay waste handling. Third step is about the crafting of the legal framework and the 10-year SWM Plan that provides guidelines in implementing ESWM. Fourth step is the creation of ESWM system and schedule of collection where segregated collection is crucial in ESWM. The fifth step is the construction of the material recovery facility as intervention in ESWM. After the system of ESWM has been determined, comes the sixth step, a complete information, education campaign in the barangays is widely disseminated. A dry run, the seventh step is implemented and evaluated if the whole system of segregation is followed by the barangay residents. If the result is acceptable to the barangay, full implementation follows, i.e., segregation at source, segregated collection, resource recovery at the MRF through recycling. The ninth step is monitoring of the NGO and the barangay for assessment. The tenth and last step is the enforcement of penal provisions for violations of the legal framework.

B. Streamlining Process of Barangay-based Solid Waste Handling

The streamlining process of barangay-based solid waste handling is both top-down approach and community-based. Legal framework, funding for collection vehicle and eco-shed are provided to the barangay yet, the latter as the lowest political unit is directly manning decentralized solid waste handling. The Barangay Chairman monitors decentralized collection, maintains the MRF and documents waste diversion. Below (table 3) articulates the experiences of the barangay Chairmen in the segregation, collection and transfer of waste.

1. Segregation at source

Every barangay has an ordinance on “no segregation, no collection” that serves as the center piece of the Chairman. Households must segregate waste into biodegradable, recyclables and residuals. Some recyclables are freely given to the waste workers while those collected in the MRF are sold to the junk shops. A marching ordinance from the Chairman on “No Segregation, No Collection” is strictly followed by the residents.

One of the challenges in the barangay level is compliance on segregation practices. With 35 barangays, not all of the community members segregate their waste. In fact, massive IEC activities have been conducted by the CENRO, Barangays, and NGO from film showing on how to segregate, to leaflets distributed to the households. Despite this move, not all of the residents strictly follow the barangays standing policy on “no segregation, no collection”.

2. Decentralized waste collection

Segregated waste is collected by waste workers using *tribikes* or small collection trucks per barangay. According to the waste workers, “*Madali mangolekta kung nakatribike lalo nasa makikitid na daan*” (It is easier to collect household waste in small streets and alleys using tri-bikes).

Generally, in principle, waste workers collect biodegradables, recyclers, non-biodegradables separately at different schedules per *purok*. They strictly follow the “no segregation, no collection” ordinance hence they will not collect the unsegregated household wastes. Since the barangay follows certain collection schemes, it makes further segregation in the MRF easier. Each barangay has its own collection system and set of waste workers for waste collection. The barangay collects per *purok* and on designated days.

C. Functional Material Recovery Facility

Based on RA 9003, Section 3, barangays or clustered of barangays should construct a MRF that includes a solid waste transfer station or sorting station, drop-off center, a composting facility, and a recycling facility. All the barangays in CSFP through City Ordinance 2005-02 and incentives given by the City have MRFs although some need monitoring to sustain its operation. The MRF is a major component of waste management practices in the barangays. Waste collected from the households are temporarily stored in segregated cells in the eco-shed. The MRF serves as a holding area within the barangay where solid wastes are temporarily stored to be sold to second-hand markets or recyclers, while biodegradables are composted to be used as soil enhancer in the vegetable garden within the premises of the MRF.

The material recovery facility is an efficient intervention in the waste stream, made of local materials, low cost structure that contains several cells of segregated materials. The facility is made of *sawali* (zero waste model), which are divided into several areas: (a) windrows compost pits; (b) storage areas for reusable materials and recyclable materials; and (c) storage for residuable materials. The MRFs are usually described by being in or having a garden where compost can be made into soil enhancer. This intervention in the waste stream increases waste diversion from the landfill as recyclables enter the second-hand market. The presence of this facility further translates recyclables into monetary value that provided profit to waste workers.

DISCUSSION

Institutional arrangements as key drivers in zero waste

Based on the zero-waste model of Zaman and Lehman (2011), key drivers are based on short term and long-term strategies. In the case of CSFP, the ten-step approach initiated by the civil society in collaboration with CSFP, has both short term and long-term implementing strategies. The information, education campaigns together with the whole system of segregation, decentralized collection and MRF as intervention are part of the long-term strategies. The short-term strategies are the low cost and local materials used in the construction of the MRF, as well as city and barangay ordinances. The use of materials for MRF may change overtime and the crafting of city and barangay ordinances may improve based on the practices of the residents. These drivers of zero waste facilitates the conversion of wastes into resources (Zaman and Lehman 2011).

Zero depletion legislation and incentives set the goals of zero waste. The implementation of “no plastic bag ordinance” and “no segregation, no collection” has been part of the barangay’s way of life. Institutional arrangements served as anchor of Zero Waste. Castillo (2019) traced the roles of environmental political institutions in the democratization of city solid waste management. It starts from the national level through RA 9003, which mandates segregation at source, then cascades downstream up to the community level through city and barangay ordinances.

Castillo (2019) further argues that the ecological space of Zero Waste is also a space for the practice of autonomy. Segregation of waste may be a mandate, a command that people ought to follow; yet it creates a condition where people, the household members take responsibility over their community as part of the management system. Figure 5 also shows that this facilitation of duty to segregate is made possible through the presence of civil society organizations.



Figure 3. The autonomy stream (Castillo, 2019) the growth of autonomous solid waste management arising from solid waste practice.

CSFP has the presence of civil society that promotes zero waste; more so, the civil society partnered with both the city government and the barangay government as networked environmental political structures. With the facilitation of the civil society in the compliance stream, the figure changed into autonomy, where those who comply become practitioners of zero waste (see Figure 5).

Streamlining creating a circular movement waste stream

By streamlining the waste stream process in the barangay level, a circular movement of waste from the HH to the MRF (see Figure 3) was crafted.

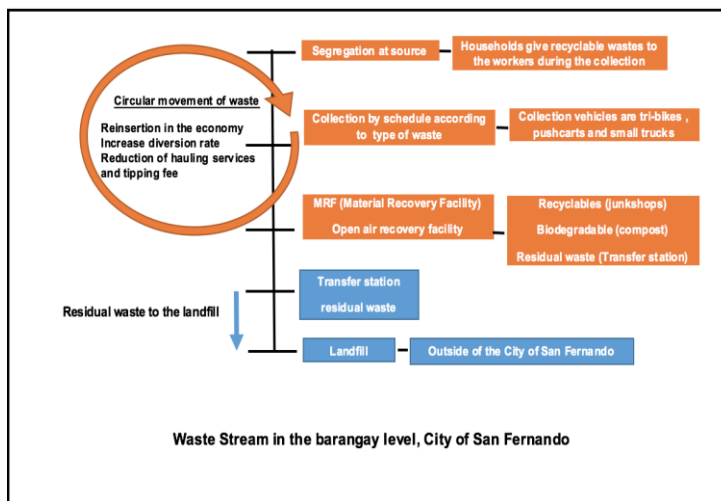


Figure 4. Circular waste stream in CSFP.

Segregation from the households, segregated waste collection and recycling in the MRF diverts waste from ending up in the landfill. Through recycling waste enters the second-hand market back to the society as environmental good. The circular movement of waste from the household to the MRF moves toward zero waste through decentralized waste handling, with MRF as the main component side by side with economic and social benefits.

The MRF as community-based non harmful technology

MRF in the barangay level requires minimal waste transportation cost, as the facility is (usually) within the barangay. It is non-pollutive, poses no threat of gas emissions, and recyclables, economically helpful to the waste workers. The MRF provides a community space for resource conversion, protecting the barangays' open spaces from being used as a dumping area. The ordinances on "no plastic" and "no segregation, no collection" reduces hauling services or reduction of the volume of waste in the waste flow.

Through segregation and second-hand waste trading, the MRF curved the linear waste stream. MRF enhances material conservation goals (Ni-Bin Chang, 2004), as well as strengthening cyclical movement of waste. It is instrumental in increasing waste diversion; it also reduces the high cost of hauling and continuous payment of tipping fees draining public funds to solid waste disposal. Thus, through the MRF, continuous recycling takes place, the extra disposal costs such as tipping fees are eliminated, more jobs are generated, and junk shops operations in the local level are strengthened (Dubanowitz, 2000). Moreover, the diversion through MRF reduces harmful emissions of landfill gas that damage the environment. The MRF as a tangible infrastructure, a technology and platform for illustrating social assets and economic benefits, is an effective tool in avoiding waste from going into the waste stream.

Waste diversion

Waste diversion means avoidance of waste in the landfill. The higher the diversion rate, the more waste is converted into resources. CENRO documents the diversion rate as reported by the barangays in terms of residuals (sanitary pads and diapers, styropor and plastic packaging) generated. These residuals are measured in weight per kilo and are put inside the sacks based on types of wastes; after which the barangay will bring them to the city transfer station (CTS) in Barangay Lara. Through segregation at source, composting and recycling at the MRF, wastes are diverted from the linear path of solid waste reducing collection and hauling costs, tipping fees in the provincial sanitary landfill. The waste diversion is computed based on the following:

1. Total Waste Generated = Barangay Population x .59 (waste generated per kg/person/day)
2. Waste generated per year = population x 0.59 x 365
3. Waste diverted per year = waste generated minus waste disposed

Assumptions:

1. Recyclables and biodegradables are already processed in the barangay MRF (sold and composted)
2. .59 waste generated per person/kg/day (average for the whole city)
3. Residual are measure per sack/per kilo
3 kilos per sack of plastic and styro (average weight per sack)
30 kilos per sack for diapers and sanitary pads (average weight per sack)
4. 10% uncollected or undocumented wastes

The weight diversion rate is part of the ten-year solid waste management plan submitted to National Solid Waste Commission every semester; to Department of Interior and Local Government every quarter thru Barangay Environmental Compliance Audit and submitted to the Department of Environment and Natural Resources every six months (Self-Compliance Monitoring and Auditing Report or SCMAR).

Below (Table 3) illustrates that percentage of diversion rate in the barangays that increases through time. There was a big gap in the percentage from 2012 to 2013 as more wastes are diverted from the landfill. The year 2013 marked the citywide implementation of ESWM in collaboration with MEF. However, diversion rate slides in 2016 but recovered in 2017.

Table 3. Diversion rate of solid waste from the disposal facility.

Year	Waste generated (Year in kg)	Waste diverted (Year in kg)	Percentage/year
2012	61,571,149	7,388,538	12%
2013	61,571,149	33,864,132	55%
2014	61,571,149	44,946,939	73%
2015	66,039,016	48,208,481	73%
2016	66,039,016	45,566,921	69%
2017	66,039,016	50,189,652	76%

(Source: CENRO, 2018)

Table 4. Diversion rate per year.

Year	Waste Generated	Waste diverted	Difference in previous year	Percentage
2012	61,571,149	7,388,538	NA	12%
2013	61,571,149	33,864,132	26,475,594	55%
2014	61,571,149	44,946,939	11,082,807	73%
2015	66,039,016	48,208,481	3,261,542	73%
2016	66,039,016	45,566,921	(-2,641,560)	69%
2017	66,039,016	50,189,652	4,622,731	76%

Perceived benefits of streamlining waste handling

The barangay chairman is viewed as an influencer of the grassroots, where he initiated the crafting of the barangay ordinance on waste management and the construction of the MRF with the support of the city government. As the “no segregation, no collection” ordinance is strictly implemented, residents became aware of their responsibilities in the community. As incentives, environmental competitions are held to select the cleanest barangay. Such projects encourage residents to clean their surroundings and waterways, working together to earn points for the competition.

The economic benefits of streamlining waste handling through decentralized practices come in two forms: institutionalize the waste workers (honorarium of Php 200 per day and sales proceeds from recyclables are given to them); material (vegetables in the compost garden and soil enhancer for backyard gardening).

The recyclers economically benefit from the waste initiatives of the barangay. The recyclers buy recyclables from the waste workers and these environmental goods re-enter the secondary market. Since

there is strict implementation of waste segregation, more recyclables are sold to the junk shops improving their economic opportunities together with their workers. The profit from the sales of recyclables is awarded to the waste workers in addition to their modest salary.

On the other hand, the social benefits of zero waste practices are long term processes such as social change, community protection, community cooperation, capacity building, political will, and changes waste handling practices.

Social change. The “no segregation, no collection” ordinance brought social changes to the barangays. After implementing the ordinance, residents gradually improved their disposal behavior and followed the collection scheme. Part of social change is protecting community spaces from being used as dumping areas. Through community compliance of the ordinance, vacant spaces, frontal spaces of households were protected from being used as dumping areas. The households will only bring out the segregated wastes on scheduled days with specific type of waste. Residents who do not abide by the barangay are summoned to explain their actions in the barangay and sign a commitment/agreement in the barangay logbook. Community activity, as well as discipline, were strongly cultivated through IEC programs.

Incentives. The various events and celebrations sponsored by CSFP through the barangay enhanced community participation. These events and celebrations encouraged the community residents to become creative and competitive in showcasing best practices on solid waste management. These competitions boost the morale of the residents, who are proud of their accomplishments for community development.

Changes in waste handling. The implementation of the 10-step holistic approach of MEF improves awareness on environmental values. The barangay residents cooperated and complied with the barangay ordinance on segregation at source and led to change in outlook on solid waste practices.

A major component of waste practices is behavioral shift (Lehmann, 2011) of the residents from disposal culture to resource diversion from the landfill. As a new way of thinking, linear flow of waste handling was curbed by segregation at source and decentralized collection. Through the 10-step holistic approach, people were able to forge new skills related to waste handling achieving shared vision of zero waste management. The 10-step holistic approach increases the ability of people and barangay to do what is required of them, i.e., waste avoidance.

The barangay residents were motivated to volunteer in cleaning their waterways on scheduled dates as a manifestation of their concern for the well-being of the community. Volunteerism is a public good (Brown, 1999) where they derive satisfaction in serving all the sectors in the community.

The partnership with NGO, capacity building activities, crafting of local ordinances, segregation at source and decentralized collection in the barangay worked well in encouraging the residents to comply with the national law on ecological solid waste management (RA 9003). The practice of further segregating by waste workers to separate and store for later use as raw material for manufacturing and reprocessing and a well-designed MRF; and collection system provides recycling as an economical and waste management opportunity (Dubanowitz, 2000).

CONCLUSION

Circular waste stream is the goal of streamlining solid waste handling approach, the objective of which is to work towards zero waste practice. Based on the results of the study, the management of solid

waste requires a two-way process. The top down approach coming from the City government through CENRO and the community-approach lead by the Barangay Chairman. Aside from management, the process of handling solid waste plays a major role in creating a circular waste stream. Segregation and decentralized collection are the keys in diverting waste from the landfill. More importantly, the presence of the MRF in the community through community efforts transform waste into resources. The MRF becomes a venue for community interaction between the residents, waste workers and recyclers. The garden in the MRF is shared by everyone and becomes a community asset.

Solid waste management goes beyond waste. It is a reflection of community governance. From waste, community cohesiveness is articulated, thus the local government should make use of waste management as the focal point of governance. Waste reflects discipline, cooperation, creates benefits and reduces cost.

RECOMMENDATIONS

It is recommended that a barangay-based zero waste model be used in the local government unit level as it promotes circular waste stream and waste diversion. The model composed of zero waste drivers (see Figure 5) such as: Solid waste actors, Behavioral shift and Diversion rate.

Zero waste social actors are composed of Barangay Chairs, households, local leaders and NGOs. The barangay chairman, as an enabler, leads the way to zero waste initiatives. As local executives, directly engaged with the grassroots, success of segregation, decentralized collection and MRF operations are dependent on their leadership. Strict monitoring of the local officials is important in the success or failure of solid waste handling. The 10-step holistic approach as a combination of IEC, trainings, waste characterizations, together with legislation are important drivers of zero waste practices. The IEC as a major component provides knowledge and encourages participation from various sectors in the city. Partnership of barangays and MEF capacitated the local residents through seminars, workshops, and trainings to heighten awareness programs of the city.

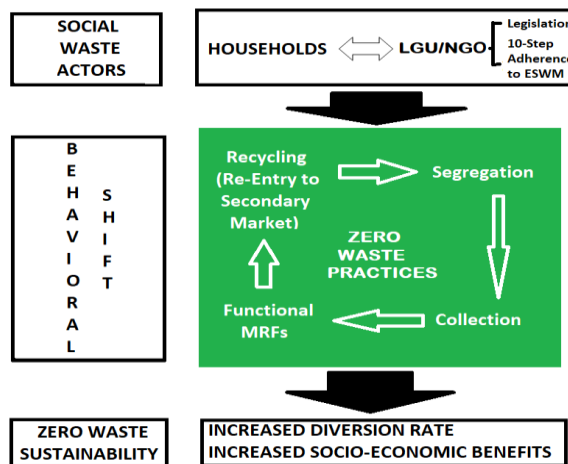


Figure 5. Emerging Zero Waste Model of Decentralized Solid Waste Handling.

Behavioral shift is the heart of zero waste practices. It begins with segregation at source, decentralized collection and further segregation at the MRF. Each barangay has its own MRF, composed of an eco-shed, an open-air structure of waste cells for segregation and composting area.

The MRF as an intervention is a visible structure where waste recovery takes place providing economic opportunities to waste workers and junk shop workers. As community asset, the MRF operation in the community level is a cost-effective way of extending the life span of commodities enhancing waste trading. The MRF provides benefit assuring that local government projects on waste handling are sustainable.

As a drop-off point in community solid waste management system, recycled materials are transported to junk shops for further reuse and recycling. Through MRF, waste diversion increases and additional disposal cost decreases. Notable in the MRF is the garden of both ornamental and vegetables where residents can avail of them for free.

Zero waste sustainability is the long-term benefit of the model. It is articulated in the socio-economic benefits gain from the behavioral shift that augment income and livelihood. Social benefits gained through various trainings, seminars, workshops and waste characterization capacitated the residents to cooperate and volunteer. Through zero waste initiatives, they became more disciplined in handling household waste which elicited community collaboration. Awards and rewards at the local level go beyond monetary values. They are manifestations that community members are working together, i.e., united in attaining the goal of zero waste.

Zero waste initiatives in the barangays are composed of incentivization, political framework, strict compliance and enforcement of local ordinances, monitoring of segregation at source, decentralized collection in the barangay, and full-blown operational MRF.

The findings crafted a systemic perspective of valuing community development through zero waste practices coupled with clean up drives, participation in environmental competitions and national environmental drives. Partnership between CSFP through the barangays and MEF facilitated capacity building of the local people on waste management, encouraging them to be creative and self-reliant. The research showcases a local government unit, with a bustling economy capable of initiating zero waste practices and at the same time showcasing socio-economic benefits promoting community development.

Policy recommendations

Based on the findings, Zero Waste practices should be incorporated as policies both in the barangay and the city level. RA 9003 is a policy from the top. However, data from the field attest that implementation was realized from the bottom (barangay and household level) and facilitated through the city government. Policy should emanate from the following actors: City Legislature through ordinances, City Mayor through programs and activities, and the barangays through barangay ordinances. Through these RA 9003 becomes decentralized as the local units make the process as their own. This becomes the starting point of compliance. This should be supplemented by patterning policies as behavioral policies, as exemplified in San Fernando, that can either lead to social or economic benefits, or even both. Since not all cities are the same, it is important to note that this is a generalized policy recommendation. Keeping in mind only the idea of targeting behavioral change in terms of solid waste handling through social and economic gains. The gains may not always be the same, but the intent will be – which is to bring about positive reinforcement for practicing zero waste.

STATEMENT OF AUTHORSHIP

AAA conceptualized the framework, made the interview guide, conducted interviews and qualitative analysis. MNG and MRVG crafted the research instrument and conceptualized the localized zero waste model. BDC gave direction in the writing of the paper. Moreover, RC conceptualized the political networking, institutional analysis, and policy recommendations. The authors facilitated in the data gathering such as interview and observations in the ten barangays.

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