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An analysis of regulatory policies on solid waste management in the Philippines: Ways forward

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An Analysis of Regulatory Policies on Solid Waste Management in the Philippines: Ways Forward

Sonny N. Domingo and Arvie Joy A. Manejar

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An Analysis of Regulatory Policies on Solid Waste Management in the Philippines: Ways Forward

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PHILIPPINE INSTITUTE FOR DEVELOPMENT STUDIES

January 2021

Abstract

Waste management issues have been hounding both urban and rural communities for decades. The passing of Republic Act 9003 or the Ecological Solid Waste Management Act of 2000 was meant to ensure the protection of public health and environment, while encouraging resource conservation and recovery, and public cooperation and responsibility. Among its critical provisions were the formal devolution of waste management to local levels, the forced closure of illegal dumpsites and investment on facilities; and the reduction and proper treatment of solid wastes. This study looked into the implementation of the law in both national and subnational levels through desk review and the conduct of case studies in selected areas, and the processing of available quantitative data. Results showed varying implementation templates across study sites, reflecting different enabling mechanisms and replicable initiatives. Documented best practices include the legal waste facility transition of the Payatas dumpsite in Quezon City and the organization of its informal economy; the clustering of waste management service of Teresa, Rizal and its province-wide incentive mechanism and partnership with construction companies; and the market linkages for revenue generation; and the strong LGU-CSO partnership in San Fernando, Pampanga. The overly simplistic transfer of responsibility to LGUs have largely resulted to two decades of mediocre policy grounding. Common avenues for improvement were also identified including the need to fast-track transition timelines; augment national and local government complementation; invest on appropriate technologies and facilities; and sustain public and private sector engagements.

Keywords: solid waste management, ecological integrity, sanitary landfill, open dumpsite, material recovery

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An analysis of regulatory policies on solid waste management in the Philippines: Ways forward

***Sonny N. Domingo and Arvie Joy A. Manejar*[1]**

1. Introduction

1.1. Background of the study

Waste generation is heavily linked by literature with urbanization, economic development, and population growth. Its increasing rates are believed to be driven by rapid urbanization, lifestyle changes, and consumption patterns, resulting inevitably to the rise of greenhouse gases emissions (Gamaralalage, Gilby, & Lee 2015; Kaza et al. 2018). The recorded figure for the world's daily waste generation was around 39,422 tonnes in 2015, but this was expected to double by 2025 (EMB 2015 and World Bank 2012). If left unmitigated, these may lead to a compounding of problems involving leachate intrusion in water tables, shifts in climate patterns, and more exposure to disaster risks.

The global solid waste management concern is similarly mirrored in the Philippines, with even more dire forecasts in certain aspects given the complexities within a developing economy. To address the growing amount of generated wastes and to put in place regulatory mechanisms, the country issued its umbrella waste management policy in 2001 through the Republic Act No. 9003, otherwise known as the Ecological Solid Waste Management Act. This legislation, in complementation with the RA 7160 or the Local Government Code, mandates local government units to serve as lead implementor and establishes the blueprint for national and subnational plans and initiatives on waste management. The frontline primacy of LGUs is recognized, with even global counterparts revealing apparent focus on municipal solid waste management, involving components on waste generation, collection and disposal (Themeleis 2003 and Dong et al. 2003).

This study revisited the state of waste management in the country and looked into four representative case study sites, two decades after the passing of RA 9003. It assessed evidences of grounded provisions vis-à-vis the objectives of the policy, observed distinct mechanisms and arrangements across LGUs, identified policy lapses and probed possible ways forward in the regulatory landscape.

1.2. Objectives

The study generally aimed to conduct a process evaluation of the implementation of the Ecological Solid Waste Management Act of 2000 (RA 9003).

Specifically, the study aimed to:

a. Review the provisions and grounding of the Ecological Solid Waste Management Act of 2000 (RA 9003), and related policies;
b. Conduct case studies on local government implementation of RA 9003, identify best practices, and describe the transition of regulatory policies as provided for by the law;
c. Recommend ways forward to augment policy and facilitate implementation.

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1.3. Policy questions

The Ecological Solid Waste Management Act has been passed into law early in 2001, serving as the country's main thematic policy anchor for two decades now. As the implementation of RA 9003 was largely devolved to the local governments, it is important to assess the process of grounding provisions particularly at the subnational level, across issues related to mandate execution, resource conservation and recovery, public and private sector participation, facility augmentation, and environmental protection awareness and action. This study sought to answer the following policy questions:

- What issues predominate in local government grounding of the solid waste management act and related policy?
- How was policy cascaded and implemented sub-nationally?
- What policy augmentations are required to address critical issues in solid waste management?

1.4. Process Evaluation

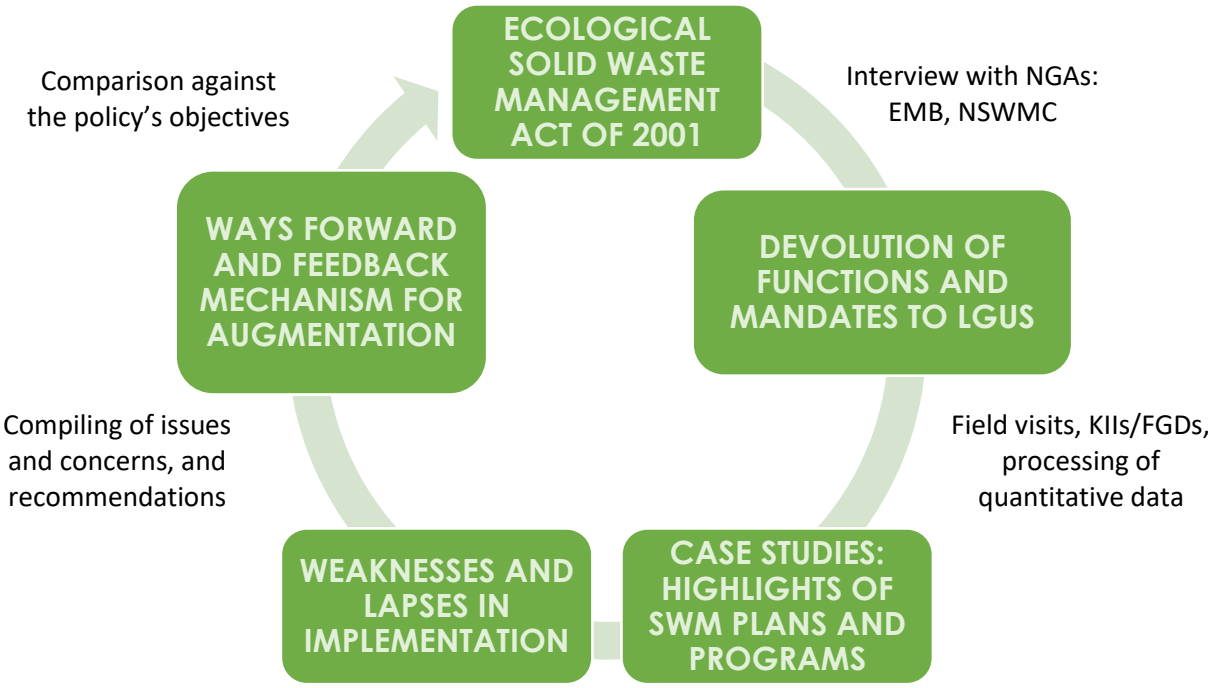
The underlying causality and theory of change behind the country's solid waste management program was anchored on policy and institutional augmentation both at the national and subnational levels. RA 9003 spelled out the transition path to a systematic, comprehensive, and ecologically sound waste management program through institutional augmentation, capacity building, and facility investment both at the national and subnational levels. Identified outputs included medium to long-term planning, establishment of solid waste management boards, and investments on material recovery facilities and engineered sanitary landfills. The study examined this critical transition, looking at how select local government units took stock of the proposed waste management mechanisms and how they interfaced with realities on the ground.

1.5. Data gathering

The skeleton of the framework followed a case study format patterned after the study of Gamaralalage, Gilby, & Lee (2015) wherein they conducted a comparative analysis of three case studies in order to look at policy provisions and how the objectives were met.

A national perspective on the status of waste management was first assessed through desk review of relevant SWM-related documents, and discussions with oversight agencies through key informant interviews (KII). These were then supplemented with on-field visits and observations in representative localities selected as case study sites accounting for differences in local economy and demography, institutional structure and political culture, and physical/ecological landscape.

Figure 1. Conceptual framework, a cyclical illustration of Gamaralalage, Gilby, & Lee study



Source: Gamaralalage, Gilby, & Lee 2015

The sites were as per recommendation of the Environmental Management Bureau (EMB); the list encompassed representatives of best and critical sites with respective transitions to the mandated provisions in compliance with the law.

Table 1. Summary of study sites

Study site	Rationale	Critical Feature
Quezon City	Location for Payatas dumpsite, model process for transition and rehabilitation	Facility transition from open dumpsite to engineered sanitary landfill
Rizal province and Teresa (municipality)	Home to three SLFs servicing Metro Manila, great incentive system, waste facility and livelihood generation	Clustering arrangement between adjacent LGUs
Bulacan province and Paombong (municipality)	Had an Ombudsman case related to open dumpsite	Failed facility transition
Pampanga province and San Fernando City	Promoted zero waste lifestyle, close engagement with NGOs	CSO participation

Source: Authors' list

1.6. Data analysis

Quantitative data were gathered from the same study sites, ranging from waste generation to investment costs. For the former, a national snapshot of waste figures was compiled using waste analysis and characterization study (WACS) conducted by EMB-NSWMC, waste analysis and brand audit (WABA), Annual Survey of Philippine Business and Industry (ASPBI), and Census of Philippine Business and Industry (CPBI). These were then processed through R Studio.

2. Global landscape of solid waste management

2.1. Waste management and status of systems

Often associated with population growth and economic activity, increased generation of solid wastes around the globe has become a primary cause of concern in terms of impact on human health and ecological integrity. The cumulative density of generated wastes was said to be equivalent to 1.6 billion tonnes of greenhouse gases emissions in the atmosphere. In 2016 alone, 242 million tonnes of plastic wastes were recorded, 12 percent of which were municipal in origin. Forty percent of these were disposed in landfills while 33 percent were openly dumped. Only 19 percent were recycled or composted while 11 percent were incinerated. This objectionable state has to be improved if a more dire solid waste management crisis is to be averted in the near future.

The apparent focus on municipal solid waste[2] was largely due to the devolution of SWM mandates both in the Philippines and abroad. This was reflective of a concern that has become one of the most pressing environmental and public health issues at the local level. A common devolved function was waste collection, a service commonly provided at the municipal level through door-to-door and curbside pickups, use of community bins, self-delivery, and delegated service. Unsurprisingly, waste collection rates were higher in urban areas compared to rural areas. Another function handed over to the municipalities and cities was waste disposal, with methods ranging from open dumping, landfilling, and incineration. Incineration was commonly used by developed countries due to its benefits on electricity and steam for heating as by-products whereas landfilling, while cheaper in capital, has led to land shortages in countries like China (Themelis 2003 and Dong et al. 2003).

2.2. Generation patterns

Waste management mechanisms across countries varied, usually responding to their respective generation patterns and waste characterization. As such, these variabilities showed interdependence with income levels, regional clusters, and economic development. For instance, the higher the GDP and per capita income of a country, the more plastics and paper waste they generated, whereas the lower the GDP, the higher the biodegradable wastes generated (EPA 2010, Shekdar 2009, and Yadav & Samadder 2017).

Organic matter made up most of the wastes in Asia, indicating the region unfit for incineration technology. These states would have to incur additional costs and extract additional resources, hence making the venture uneconomically viable (Roberts-Davis & Guerrero 2018). A glimpse in fiscal utilization showed that Asian countries' waste expenses amounted to approximately 4.4×10^9 t/y, and an average of 25 million USD in solid waste management annually (Pappu et al. 2011; Hoornweg & Bhada-Tata 2012).

3. Policy, institution, finance

3.1. National baseline policies

It was not until the passage of RA 9003 that an in-depth waste characterization study was adopted to guide management mechanisms. Initially, the policies that shaped the SWM system of the Philippines was scattered across components. The first baseline policy, Presidential Decree No. 825 in 1975, was centered on penalizing littering. This was followed by the devolution of waste disposal to municipalities through DENR Administrative Order No. 1998-49, and a constitution of Presidential Task Force on Waste Management through Memorandum

[2] Municipal solid wastes are defined by OECD and PAHO as containing both domestic and commercial solid or semi-solid wastes sourced from households, small-scale industries and institutions, and market street sweeping (Hoornweg & Perinaz 2012).

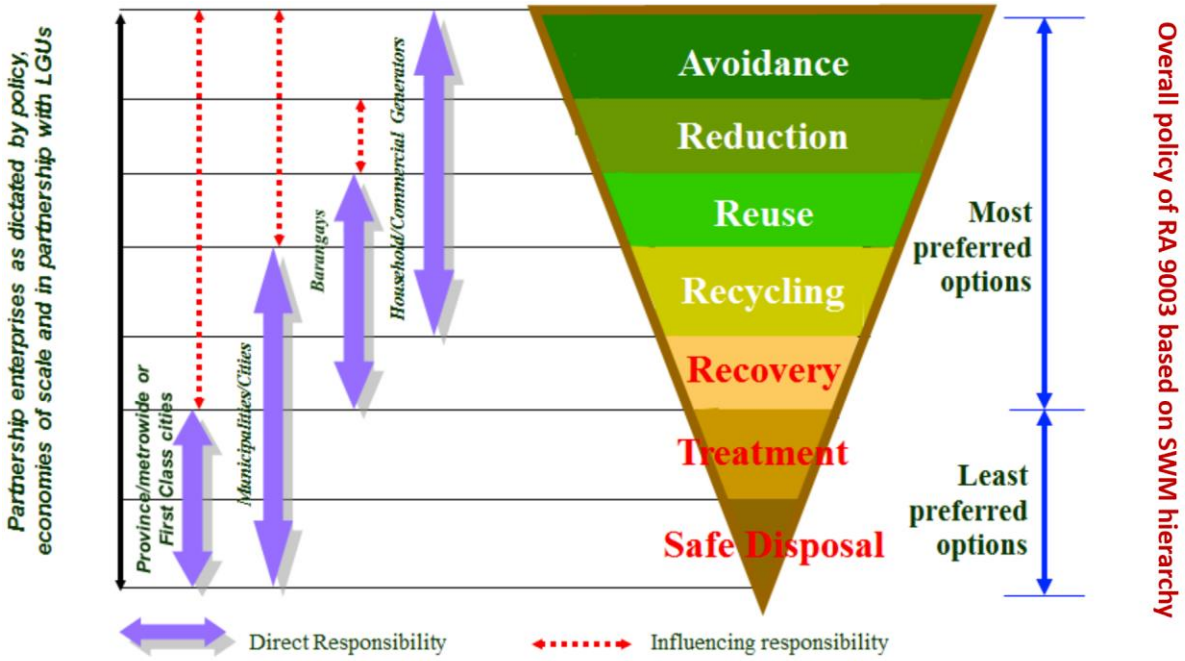
Circular (MC) No. 1988-39A. Regulations for landfill site identification were issued next in line with the former DAO.

The complete and systemic approach needed to tackle waste management was passed during the advent of the 21st century, with the strong addendum of ecological aspect, possibly facilitated by international commitments to climate change mitigation. This declaration, together with the Local Government Code, mandated for the devolution of segregation and collection of residential solid waste to the barangay level while special and hazardous wastes were to the municipal/city LGUs. Another significant mandate was the forced closure of all pre-existing dumpsites and transition them into sanitary landfills (SLF) within five years of the law's passage.

The law also required the establishment of a solid waste management board that would oversee the carrying out of the solid waste management plan. As of 2015, there were 1,305 SWMPs submitted to the National Solid Waste Management Commission (NSWMC), however, there seemed to be a disparity between the volume of submitted plans and the approved ones. The backlogs were rooted from missing components and non-compliance of requirements, resulting to a staggering progress of approval.

The figure below showed the hierarchy of SWM tactical options as embodied in RA 9003. Waste avoidance, reduction, reuse and recycling were preferred over eventual treatment and disposal. It was also evident that the most preferred options were best carried out at the level of waste generators. In this case, interventions seemed to best start at the level of households and commercial establishments.

Figure 2. Solid waste management options based on RA 9003



Source: NSWMC 2015

3.2. Complementary policies

Since the passage of RA 9003, there were some landmark policies that followed suit, most of which were issuances aligned with international commitments such as the Kyoto Protocol and

the Basel Convention[3]. The provisions were consistent with the goals on mitigation and emission reduction. In particular, the Clean Air Act of 1999 (RA 8749) and RA 9003 prohibited incineration technology, particularly enshrined in Sections 2D and 3D of the latter and Section 20 of the former. Other laws were the Toxic Substances and Hazardous and Nuclear Waste of 1990 (RA 6969), Climate Change Act of 2009 (RA 9729), and Code of Sanitation of the Philippines (PD 856).

The table below outlined the important baseline and functional policies that were passed complementing the Ecological Solid Waste Management Act of 2000.

Table 2. List of complementary policies to Ecological Solid Waste Management Act of 2000

Baseline Policies	
RA 6969	Toxic Substances and Hazardous and Nuclear Waste Act of 1990
RA 7160	Sections providing for devolving of cleanliness and sanitation roles to LGUs
RA 8749	Clean Air Act of 1999
RA 9275	Philippine Clean Water Act of 2004
RA 9512	Environmental Awareness and Education Act of 2008
RA 9513	Renewable Energy Act of 2008
RA 9729	Climate Change Act of 2009
PD 856	Code of Sanitation of the Philippines
PD 1586	Environmental Impact Assessment Law
PD 1160	Punong barangays to enforce pollution and environmental control laws
EO 774	Creation of 13 task groups on solid waste management
RA 9003	**Ecological Solid Waste Management Act of 2000**
PD 825	Penalty for improper disposal of garbage
Functional policies	
DENR DAO 1998-49	Technical guidelines for municipal solid waste disposal
DENR DAO 2001-34	IRR of RA 9003
DENR AO 1993-90	Project management office on solid waste management
DENR DAO 1998-50	Adoption of landfill site identification
DENR MC 1988-39A	Reconstituting Presidential Task Force on Waste Management
EO 2004-301	Establishing Green Procurement Program and National Eco-Labeling Program

Source: Authors' list

3.3. Institutional organizations

The National Solid Waste Management Commission is a multi-agency body institutionalized to carry out RA 9003 with the EMB as its secretariat. It is composed[4] of 14 members from the government and three members from the private sectors, the heads of government agencies were to operate in their ex officio capacity. Like any multistakeholder body, the Commission may invite representatives from other agencies or sectors when concerns arise.

Among the Commission's many functions were the supervision of national and local solid waste management plans, and facilitation of policies to meet the objectives of RA 9003. As they were the approving body for SWMPs, they were expected not only to supervise but extend assistance in coordinating linkages, augmenting resources, and creating mechanisms for penalty sanctions and incentives. More importantly, they were to create programs which could

[3] Basel Convention is an international treaty entered into force on 1992 created to limit and reduce movements of hazardous waste among nations. It particularly restricts the transfer of wastes from developed to less developed countries (LDCs) (http://www.basel.int/).

[4] NSWMC members included heads of DILG, DTI, DOST, DA, DOH, DPWH, TESDA, MMDA, Philippine Information Agency (PIA), DENR, League of Provinces of the Philippines, League of Cities of the Philippines, League of Municipalities, Liga ng mga Barangay. The private sector's representatives were to come from the recycling industry, plastic industry, and an NGO.

improve technical capabilities of implementors, and link the LGU's value-added recyclables to existing markets, thereby facilitating livelihood generation in solid waste.

The structure of the commission was replicated in all subnational levels through the solid waste management boards. The barangay SWM board, the level where bulk of waste management usually occurred, was said to comprise of Sangguniang Bayan members. Their role revolved around establishing relevant local ordinances and rationalizing budget for the carrying out of activities. Local governments were given the discretion to create specific divisions and designate focal persons. The discussions later on case studies will reveal arrangements across sites and how they reflect the priorities of current administration.

External institutions like the private sector played critical parts in the institutional setup of both national and subnational bodies. Evidences of their engagement ranged from financing, collection, and disposal activities hence why public-private partnerships were encouraged as a primary modality to augment logistical and financial lapses. Meanwhile, presence of nongovernment organizations (NGOs) were highlighted in the consultation process; such was the role of the Mother Earth Foundation for the SWM plan formulation of San Fernando in Pampanga, Nueva Vizcaya, and Batangas City among others.

3.4. Local devolution of waste management

3.4.1. Regional profiles

Unlike the national landscape where policy and institutional arrangements were more straightforward, local implementation was more convoluted and held more nuances in enabling conditions. The shortlist provided by EMB Solid Waste Management Division was a mix of highly urbanized cities (HUCs) and rural municipalities which showcased best practices and examples of transition in the landscape.

One of the HUCs was Quezon City, the largest among the LGUs in the National Capital Region with an area of 16,112.58 hectares. The city also had the biggest population figure at 2.94 million (2015 census), consistent with its 41.57 percent share of residential developments in land use. Included in its jurisdiction was the 22-ha open dumpsite in Payatas that operated from late 80s to 90s but was shut down in 2000 when the accumulated garbage triggered a landslide and further escalated to combustion, burying at least 300 waste pickers (Ofreneo 2012) and killing another 1,000 (indicative figure). Their rehabilitation process could be a model for other transitioning LGUs.

Adjacent to this study site was the landlocked province of Rizal which was deemed as a strategic location by most urban planners due to its proximity to NCR. Despite being considered as predominantly urban, Rizal was still home to protected areas and forested lands which were being utilized by extractive sectors e.g. mining, quarrying, and agro-industries. One of its municipalities, Teresa, was recommended for its model MRF and their marrying of local waste management and the aforementioned industries.

Pampanga and Bulacan both comprised the third study site as representatives of Central Luzon's regional profile. The former has a smaller area and population compared to the latter, but this position was reversed in terms of income and economic activities. Bulacan was mainly dependent on its primary sectors (e.g. agriculture, fisheries, and forestry), and seconded by manufacturing, mining and quarrying, electric power generation, gas and development, and construction. Pampanga's economy, on the other hand, was driven by gastronomy and artisan production. This would later come into play in their waste generation and strategies.

Some of the sites mentioned the growing problem of migration, usually ushered in by a developing tourism industry or a widening industry base for employment, which may then lead to increasing waste figures. The presence of informal economy[5] also overlapped across the localities' narratives, facilitating creation of unique strategies in streamlining them into primary waste mechanisms.

3.4.2. Policies and ordinances

Local governments tended to pattern their policies and ordinances with national issuances, and even then, their initial policies were not as comprehensive and encompassing. Some of Quezon City's first declarations focused on prohibiting open dumping and littering, but it eventually grew in its influence when the city institutionalized junkshops in waste management through Ordinance No. SP. 1711 s. 2006.

Rizal's priority for SWM integrated through greening programs was prevalent in both provincial and municipal levels, and further institutionalized it through Executive Order No. 11 in 2018. Before Teresa was branded as a model MRF, it had to go drastic reformations under its past leaderships. The LGU laid in place ordinances targeting anti-littering, and a strict environmental inspection policy for potential commercial polluters. The combination of policy and massive IEC helped their compliance level to RA 9003 shoot up from 20 percent to 80 percent. The current set-up of Teresa managed to garner awards across the years – Rotary Club Makati's zero-waste lifestyle and first place in DILG's Environmental Compliance Audit 2016 among others.

While most of the municipalities and cities in both representative provinces in Region 3 have their SWMPs already approved, their provincial governments were not able to acquire the same status. The delay was reportedly due to the lengthy gestational period of review and approval process in the national level. However, it was assured that the SWMP was streamlined in the Provincial Development and Physical Framework Plan (2010-2030) through the province's People's Agenda 10 under the bigger theme of disaster risk reduction and climate change adaptation. Ironically however, one interesting ordinance from Bulacan was Provincial Ordinance No. C-005 issued in 2011 which allowed incineration[6].

For Pampanga, the delay in SWMP approval was the limited assistance of external consultative bodies in contrast to its capital, the City of San Fernando (CSFP), which received wide-ranging workshops and writeshops from Mother Earth Foundation (MEF), DILG Region 3, and NSWMCS-EMB Regional Office.

3.5. *Local counterparts of institutions*

Institutions in the local level were also patterned after national bodies. NSWMC, for example, was devolved as solid waste management boards in municipal and barangay levels with similar mandates but with arbitrary compositions[7]. There were deviations in additional stakeholders like the women's council in Teresa, Rizal or the Police Provincial Office in Pampanga.

In the barangay levels, solid waste management committees took on the functions of collecting and segregating, establishing required facilities, and allocating barangay funds, but they fell

[5] These included junkshops, waste pickers, scavengers.
[6] This provincial ordinance allowed for its use with this passage, "installation, establishment, and operation of incineration or composting plants, or the alteration/modification of any part of thereof shall be regulated and permitted under the environmental code provided that they comply with the requirements of this code."
[7] These usually involved one representative from the Sangguniang Bayan, president of the Association of Barangay Councils, chairperson of SK Federation, NGOs, representatives of recycling industry, and manufacturing or packaging industry.

short in delivering compliance levels. In Quezon City, only 64.08 percent of the barangays were able to form them, and an even lower 21.13 percent managed to formulate plans.

Apart from the local SWM boards, mobilizing bodies and/or task forces eventually evolved into distinct divisions with functions heavily focused on enforcing programs, monitoring, coordinating, and researching. These were the Environmental Protection and Waste Management Department of Quezon City, the Ynares-Ecosystem-Program (YES Team) of Rizal, and the ENROs and General Services division of Bulacan and Pampanga. Across these offices, the distribution between plantilla, and contractual and job order employees was heavier for the latter. On the enforcement side, LGUs formed bodies or coordinated with agencies instead of deputizing from their ranks. Such examples were the environmental police and barangay public safety officers of Quezon City, and the provincial police of Pampanga.

While all concerns were assumed to be centralized in these various bodies and respective focal persons, the multiple burdens in the limited labor base tended to disorient and divide the focus and resources of local offices.

3.6. Fund sources and investment costs

Waste management tended to take the biggest chunk of the local governments' budgets, a pattern commonly observed among developing countries (Hoornweg & Perinaz 2012). It was hinged on the rationale that local governments can better identify crosscutting issues among their constituents as compared to the national government. While the latter shouldered capital-intensive infrastructure, local offices were expected to bridge the gap of limited fiscal resource (Markgraf & Kaza 2016).

From that fund, developing countries allocated more for waste collection whereas developed ones chose disposal (Hoornweg & Bhada-Tara 2012, Yadav & Samadder 2017). In particular, 20 percent of the local budget of LGUs were set aside for waste management however, this did not translate to more effective management mechanisms as 90 percent of municipal wastes were still burned or dumped (Kaza et al. 2018). Moreover, barangays, which oversaw 70 to 80 percent of the wastes, have the least funds. The other 20 percent of the waste were handled by the municipality, but only 30 percent of these areas have access to MRFs.

Investment costs were gathered from the sites visited based on their available data however, it was inadequate to surmise that it echoed the literature observation on the collection component. As seen in the table below, the funding base of the study sites were heavily comprised of local government funds, mostly coming from IRA. Other sources were indications of unique, existing arrangements in each LGU. For instance, Quezon City and CSFP were able to generate funds from penalties, implying a strong presence of enforcement in their areas whereas those with private partnerships augmented their budgets from varying fees e.g. permits, accreditation, documentary requirements etc. Only Rizal managed to source from their value-added products, albeit initially supported by loans and grants from international bodies.

Priorities can also be pointed out from the disaggregation of their investment costs. In particular, Quezon City had an annual budget of Php 828.93 million, with Php 821.33 million allocated solely for MOOE[8] in 2015. Most of the funds in Teresa, Rizal were allocated for the establishment and maintenance of ISWMF while CSFP directed their costs towards tipping

[8] MOOE – maintenance and other operating expenses

fees and augmenting MRFs in their barangays. The disaggregation was not visible from the data provided by Bulacan.

The trend of funds for solid waste management varied across the four study sites – increasing for HUCs, decreasing for Bulacan, and ambiguous for Rizal. However, resource limitations were still evident in the discussion of additional facilities and technology adaptions, pointing to the need for a more diversified funding base.

The national government mulled over the role of funding and credit institutions to augment the budgetary limits of local governments. Apart from that, a centralized fund pool solely for SWM may be considered for SWM in cognizance of the small amount the national SWM has collected. Another method would be through subsidies and dole-outs with endorsements from city and municipal ENROs.

Table 3. Funding sources, priorities, and SWM fund trend across study sites

LGU	20% IRA	20% LDF	Gen. Fund	Penalties	Permit fees	Accreditation, documentary	ISWMF products	External bodies	Priorities	Trend
QC	✓	×	×	✓	×	×	×	×	MOOE	Increasing
Rizal	✓	✓	✓	×	✓	×	✓	✓	ISWMF	Ambiguous
Bulacan	✓	×	×	×	×	✓	×	×	Not mentioned	Decreasing
CSFP	✓	✓	✓	✓	×	✓	×	✓	Tipping fees and MRF	Increasing

Source: Authors' analysis

4. Waste generation and facilities

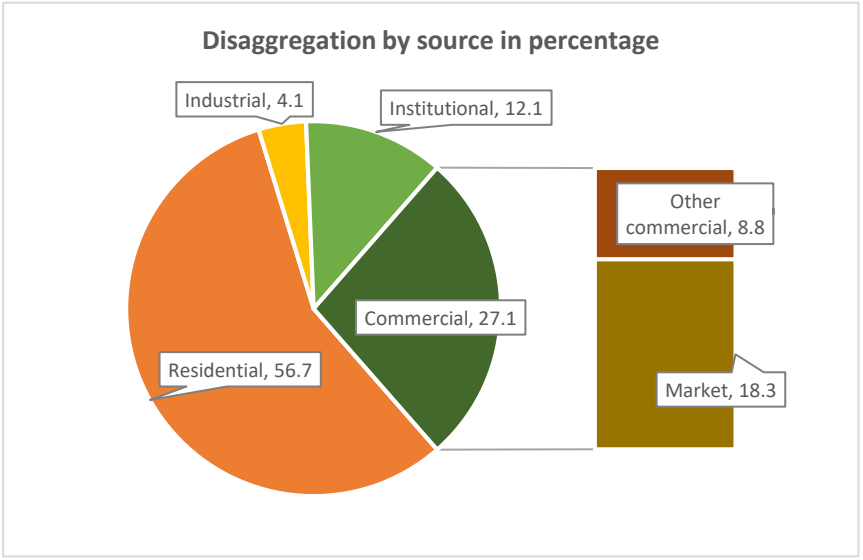
4.1. Overview of national waste generation

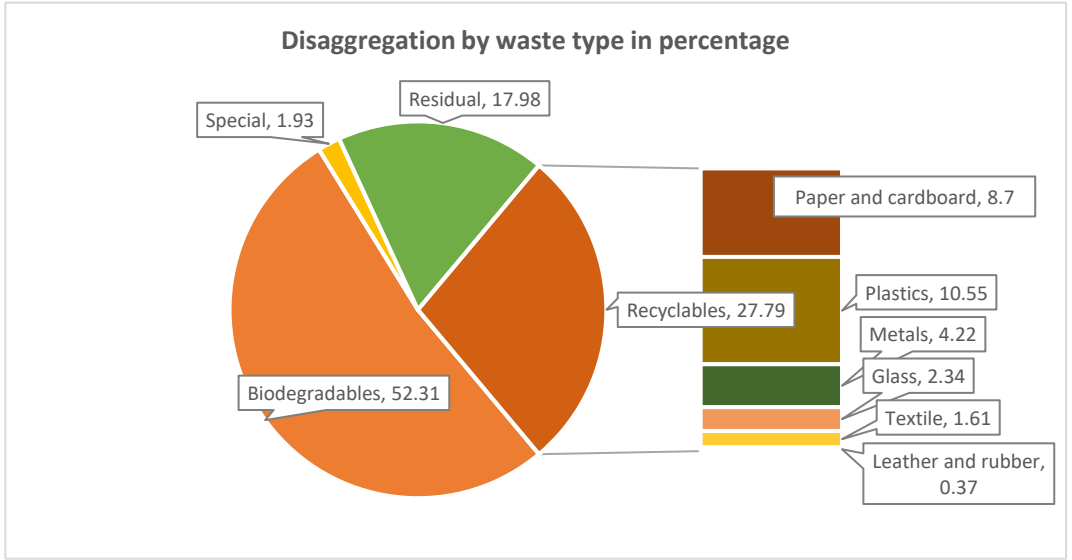
The most recent comprehensive report generated by the NSWMC was released in December 2015 based on 2013 data. There needs to be a more current appraisal of the sources, composition and volume generation of wastes in the country.

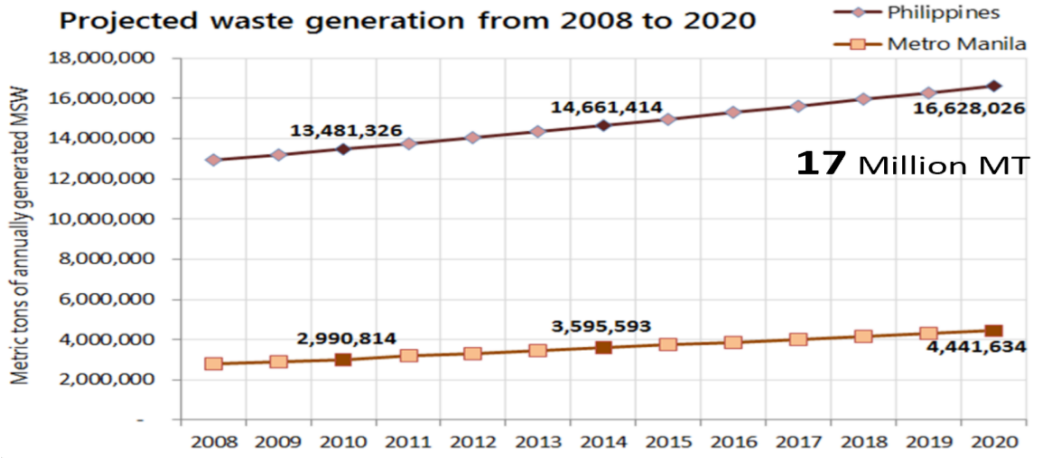
The NSWMC conducted WACS to adjust its baseline assessments and have a better grasp on the national solid waste landscape. It was revealed that 57 percent of the country's wastes came from residential areas, followed by 27 percent from commercial sources[9], 12 percent from institutional offices[10], and four percent from industrial and/or manufacturing sector (NSWMC 2015). Using the same analysis, it was found out that disposed wastes were dominated by biodegradable wastes at 52 percent, recyclable at 28 percent, residuals at 18 percent, and the remaining two percent as special wastes, reflecting similar patterns with global trends. Estimated volume generation in 2020 was projected at close to 17 million MT, with almost third of the materials coming from Metro Manila.

[9] Commercial sources include business establishments, and public and private markets
[10] Institutional sources pertain to government offices, schools and hospitals

Figure 3. Sources, composition, and projected volume generation of SWM in the Philippines





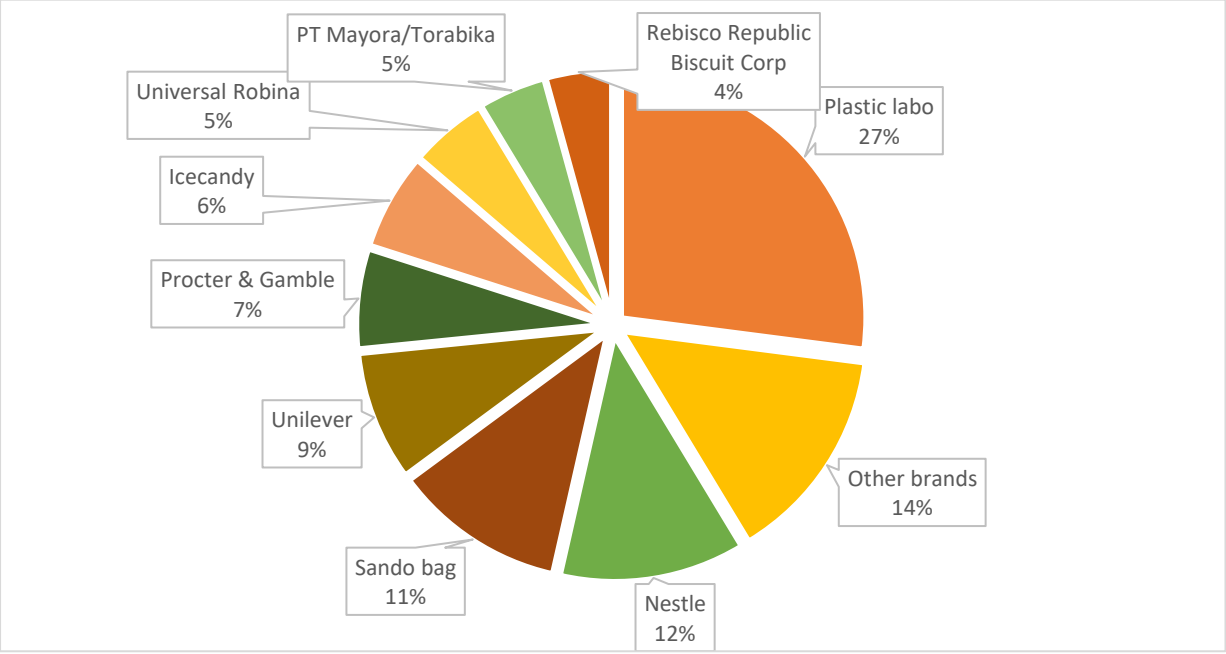


Source: NSWMC 2018

On the other hand, the Global Alliance for Incinerator Alternatives (GAIA) with MEF conducted WABA, a more comprehensive version of WACS. This methodology's advantage was the compilation of plastic manufacturers to identify "the most problematic residual waste" in the particular community. This also aimed to shift generation and accountability from consumers to manufacturers and large corporations.

Their results were quite similar on the initial disaggregation of wastes. The waste profile of the communities was dominated by compostables (biodegradable and organics) at 61.85 percent, followed by recyclables at 14.76, residuals at 13.35, and the rest was classified as special residuals and hazardous. Organics were found to be mostly comprised of kitchen wastes, glass bottles for recyclables, plastics and sando bags for residuals, diapers for special residuals, and containers of paint or solvents for hazardous category. Overall, plastic labo has the highest average share of generated waste across the municipalities. The result for this reinforced the prevalence of sachet economy[11] in the country. Interestingly, 3,286 metric tons of the waste profile summary of WABA communities were from branded wastes (Roberts-Davis & Guerrero 2018).

Figure 4. Labels with highest average share of generated waste across WABA communities



Source: Roberts-Davis & Guerrero 2018

Relevant figures were also processed from both the ASPBI from 2009 to 2016, and the CPBI[12] from 2000 to 2012. The following table showed the mean values for selected disaggregated variables. Material recovery has the highest number of facilities dedicated to it while treatment of nonhazardous wastes has the lowest in both datasets. Based on ASPBI figures, waste management pulled its highest revenue from the collection of nonhazardous wastes, equivalent to approximately 2.80 billion pesos, however, the same category also incurred the highest average cost, leaving marginal value for profit. As for subsidies, most of these were channeled to remediation, and hazardous treatment activities.

[11] Sachet economy is defined as a prevailing practice in poorer communities of buying products in single use packages. Common purchases include detergent, shampoo, powdered milk or beverages.
[12] In these datasets, waste management was categorized under other community, social, and personal service establishments.

A number of facilities were dedicated to collection while disposal facilities were minimal since majority of the wastes were assumed to be diverted. Majority of the paid labor resource was under the collection component, but material recovery was the highest for unpaid employment, indicating the indispensable presence of the informal sector.

Table 4. Average figures for selected solid waste management variables disaggregated in categories using ASPBI and CPBI

Variable	ASPBI						CPBI					
	collection of hazardous	collection of nonhazard	material recovery	Remediation	treatment of hazardous	treatment of nonhazardous	all	collection	material recovery	remediation	treatment and disposal of hazard	treatment and disposal of nonhazard
no. of establishments	7.00	21.00	59.00	9.75	11.25	5.00	46.50	28.50	46.50	3.50	12.00	1.50
total employment	237.00	948.40	1,063.50	104.00	204.50	190.33	2,124.50	1,566.00	696.50	94.50	295.50	101.50
total revenue	462,310.75	2,797,203.80	2,185,709.50	191,581.75	327,472.25	358,468.33	853,376.50	2,867,747.00	999,482.00	56,155.50	492,455.50	389,511.00
total compensation	46,830.75	263,061.80	167,545.00	37,253.00	50,002.75	50,377.33	195,158.00	291,673.50	78,647.50	18,468.50	63,092.00	23,647.50
total cost	355,965.25	2,099,308.00	1,618,064.75	172,065.75	271,852.25	220,755.00	520,279.50	2,111,582.00	846,562.50	40,370.50	388,370.00	347,646.50
subsidies	-	-	-	5,424.50	8,555.25	-	-	-	-	-	390.00	-
average number of workers	38.18	43.16	18.24	9.82	18.96	41.39	#N/A	56.50	14.50	13.50	24.50	34.00
average compensation	134,591.51	214,244.50	114,419.55	262,399.59	191,705.29	146,294.20	#N/A	186,904.50	118,031.50	106,141.00	216,417.50	117,067.00
revenue per cost	1.22	1.21	1.35	0.91	1.26	1.76	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
labor production	656,399.24	960,624.02	652,219.68	312,751.51	223,756.27	1,155,482.49	#N/A	570,416.00	322,153.50	108,069.00	320,953.00	322,768.50

Note: values in thousands

Source: ASPBI (2009-2015), CPBI (2000-2012)

Similar waste makeup was also determined from respective WACS of study sites. The QC-EPWMD's results in 2003 revealed biodegradable wastes still comprised majority of the waste makeup of the city at 48 percent, and generated approximately 630.67 tons per day, followed by paper (17 percent, 219.82 tons per day), plastic (16 percent, 206.89 percent), glass/bottle (3 percent, 38.79 tons per day), metal (3 percent, 38.79 tons per day), and residual waste (13 percent, 168.10 tons per day) respectively. The daily waste generation per capita was approximately 0.69 kilograms per person per day. Multiplying this with the 2005 population, the city's total generation then was around 1,650,963.69 kgs/day or 1,650.96 tons per day.

The figures from the WABA dataset coincided with the WACS of the city – the organics comprising most of the waste makeup in average at 29.43 percent. This was followed by special residuals and recyclables. Majority of this waste makeup were unbranded (6,725 units/64.89%). Only 33.51 percent belonged to brand manufacturers while a meager 1.50 percent remained unidentified. The next section of the table showed another disaggregation based on category. This was dominated by others and unbranded in actual values, followed by food (liquid) and drinks, and personal care.

Table 5. Waste profile of Quezon City, values in percentage for type and actual values in units for category

Type	Min	1st Quintile	Median	Mean	3rd Quintile	Max
Organics	19.21	24.32	29.43	29.43	34.54	39.65
Recyclables	0.06	0.39	0.60	1.03	1.40	3.23
Residuals	-	0.03	0.21	0.55	0.71	2.83
Special residuals	0.38	0.71	1.03	3.76	5.46	9.88
Special/bulky/hazardous	-	0.02	0.09	0.20	0.21	0.77
Category						
Food (Liquid) and Drinks	-	-	55.50	59.00	88.00	173.00
Food (Non-Liquid)	-	-	47.00	47.76	59.00	199.00
Household	-	-	4.00	40.45	45.50	215.00
Others and unbranded	32.00	87.75	267.50	679.60	1,176.75	2,388.00
Personal care	-	-	18.00	54.60	79.50	292.00

Source: GAIA 2019

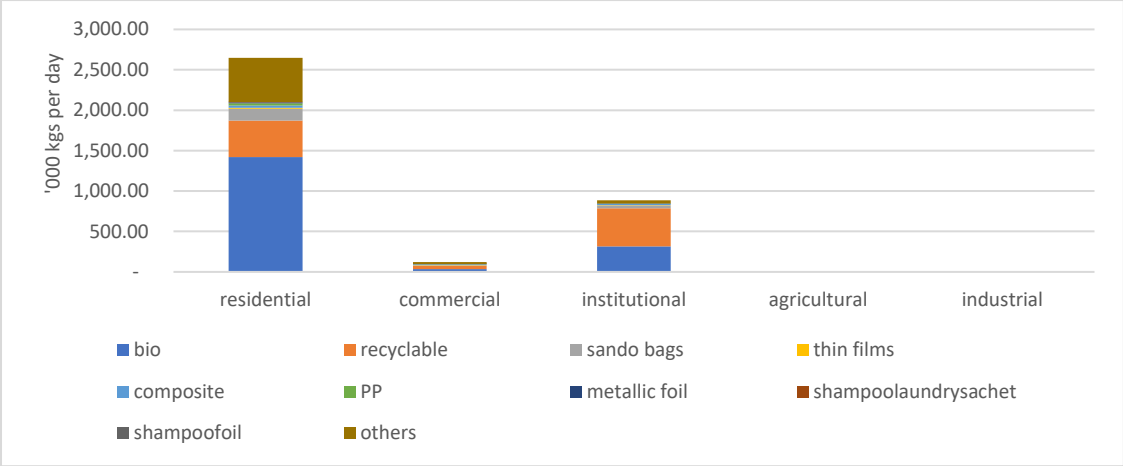
As for Rizal, 85 percent of the waste collected from each barangay MRF were residuals. In 2007, the municipality of Teresa churned out 8.74 cubic meters of waste daily, accumulating 2,919 kgs of wastes. Biodegradables were responsible for 460 kg of the average weight, recyclables for the 979 kgs, and the residuals for the remaining 1,480 kgs, majority of which came from non-households entities e.g. establishments, markets.

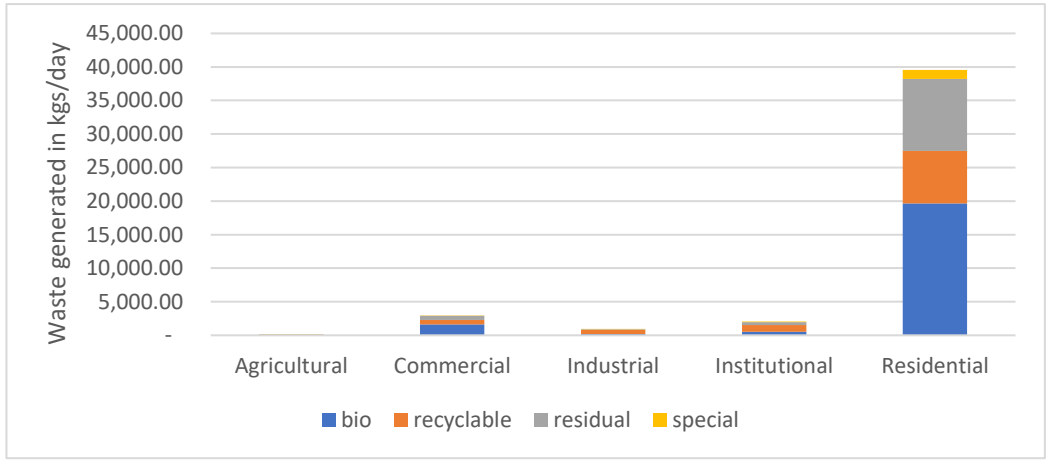
On the other hand, both Bulacan and Pampanga's wastes were recorded to be from residential areas. In particular for the former, the residential was responsible for 57.11 percent share, followed by institutions (39.12 percent), and agricultural wastes (0.02 percent). Of these, 65.3 percent were biodegradable, 42.4 percent were residual, 35.4 percent recyclable, outright disposal was 8.2 percent, and special wastes were 9.3 percent. Unlike Bulacan, Pampanga's next major generator was commercial establishments. It was likely that biodegradables comprised most of the share in this province as it was mainly driven by its food production industries.

One striking finding for this was the difference in the amount of wastes. While Bulacan has the bigger land area and the higher population, Pampanga still generated more. This was a great reflection of their major industries and economy contributors. As Bulacan was more environment-dependent, they have lesser figures compared to the production-centered Pampanga.

The next figure showed the side by side comparison of daily waste generated in both provinces across their municipalities and cities. In contrast to Pampanga where its capital city generated the highest, Bulacan's capital – Malolos City – was dwarfed by figures in Norzagaray and Santa Maria where previous SLFs were located.

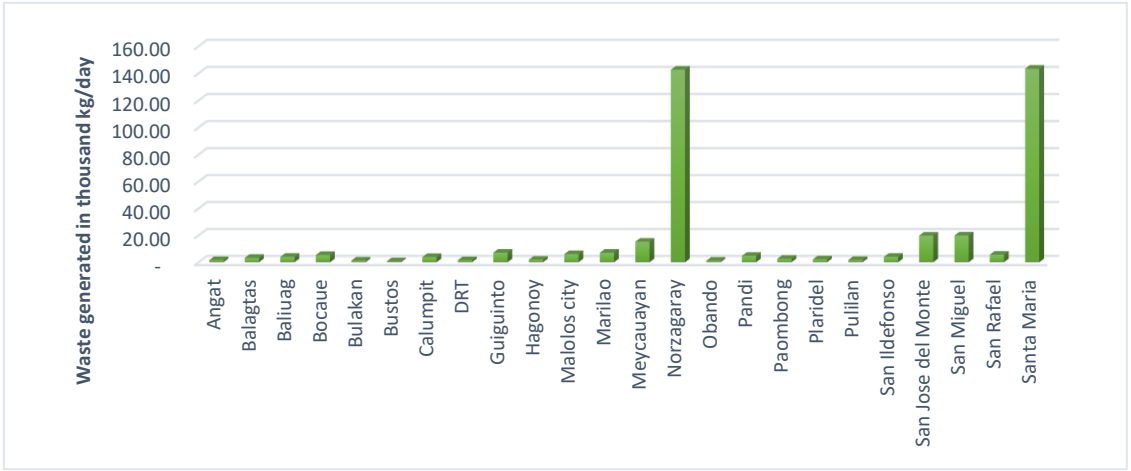
Figure 5. Average waste generated by source and by type in Bulacan and Pampanga

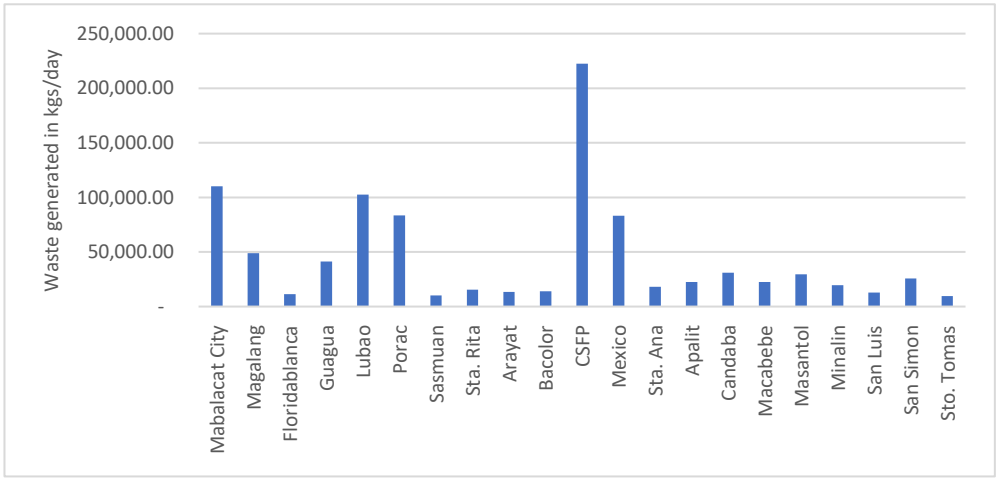




Source: Bulacan ENRO n.d. & Pampanga PG-ENRO 2020

Figure 6. Daily waste in generation across cities and municipalities of Bulacan and Pampanga





Source: Bulacan ENRO n.d. & Pampanga PG-ENRO 2020

4.2. Waste facilities in the country

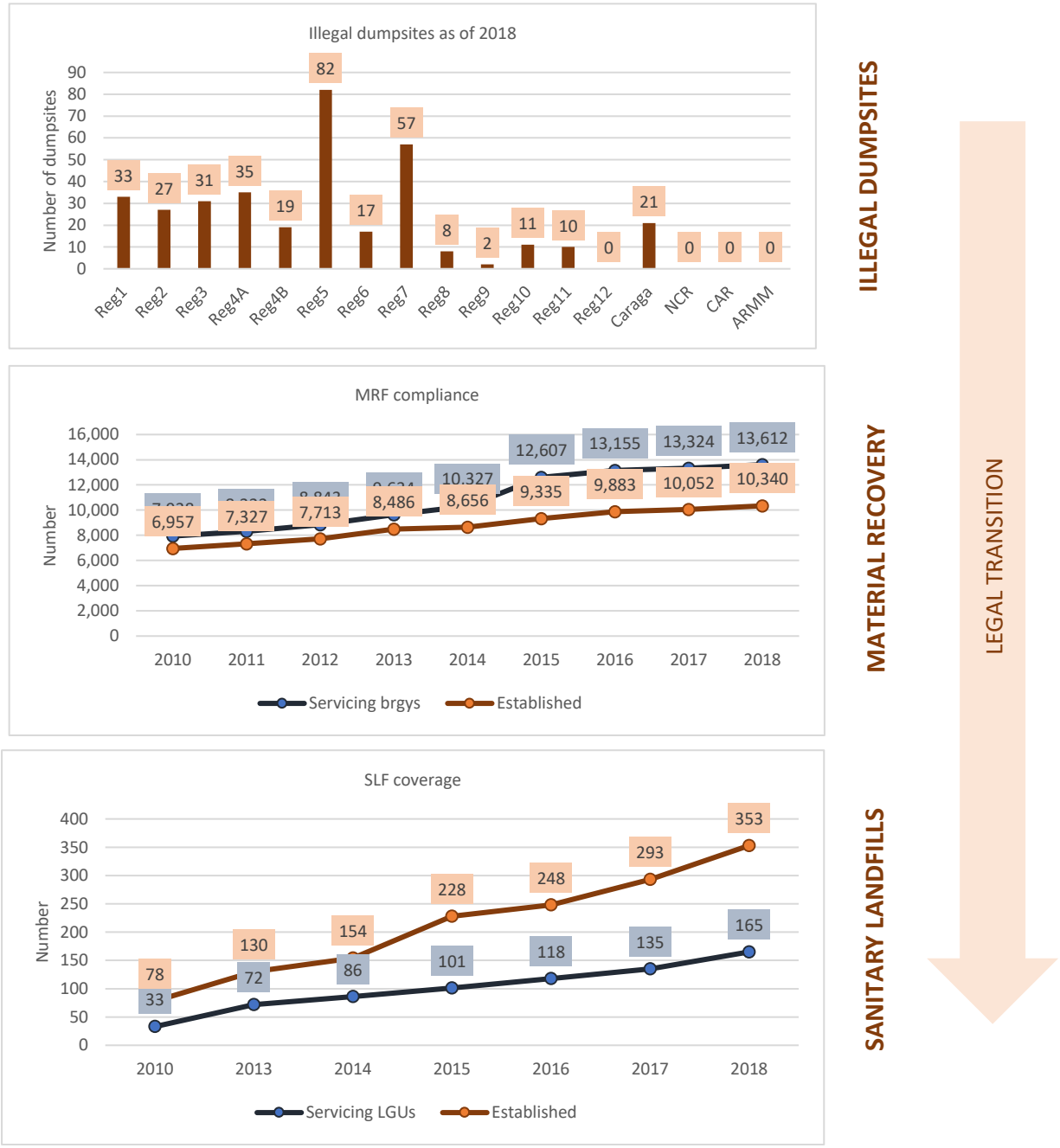
Harking back to earlier discussion on salient provisions, RA 9003 pushed for the closure and rehabilitation of all dumpsites and their replacement with SLFs[13] by 2006. It also required the establishment of MRFs for every LGU, if not for every barangay. Over the years, these facilities have steadily increased in numbers across the country as a strong indication of growing compliance, starting from around 2,500 in 2008 to 10,300 in 2018. In an ideal setting, the presence of MRFs would have diverted wastes from disposal and only residual wastes would go on to sanitary landfills however, only 14 percent of the total localities were being serviced by landfills in 2014 (Asian Development Bank 2017).

This legally mandated transition was not fully realized as many open and controlled dumps were still in operation two decades after the law's passing. Still, the number of illegal dumpsites in the country had decreased by more than half from 806 in 2008 to 353 in 2018. By 2018, the compliance to SLF improved by 22 percent with 353 LGUs having access to 165 SLFs.

This implied that a 100 percent area coverage can only be done through a clustering approach wherein small LGUs can pool their resources into setting up a common solid waste disposal facility or, alternatively, LGUs with facilities can just charge service fees for material dumping. The latter was more prevalent among LGUs with SWM facility needs. Nonetheless, both arrangements would enable economies of scale and reduce the cost of solid waste disposal, given the difficulty in finding host LGUs for the establishment of SLFs. But it would seem that a one to one ratio between LGU and landfill facility may not be viable given policy grounding performance over the past decades.

[13] SLFs are disposal facilities with impermeable liners to prevent liquid discharges from polluting ground and surface waters; gas management system to reduce risks of burning or explosion; soil cover to minimize odor; and other environmental protection features (NSWMC 2018).

Figure 7. Legal transition from open dumpsite to engineered sanitary landfill

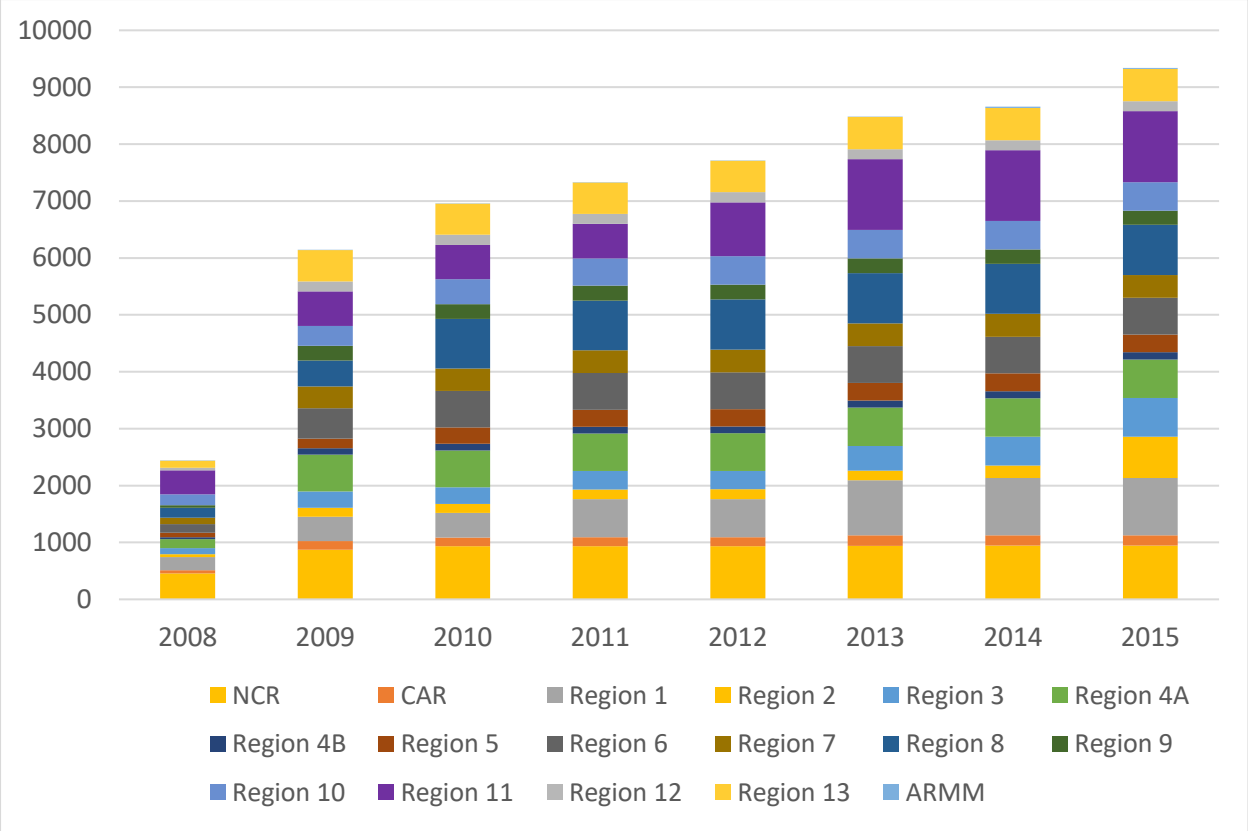


Parameter	2008	2010	2013	2014	2015	2016	2017	2018
Population	88,543,800	92,337,852	98,449,090	100,420,642	101,883,764	103,320,222	104,918,090	106,512,074
Operating SLFs	21	29	72	86	101	118	135	166
LGUs with access to SLFs	63	78	130	154	228	248	293	353
% of LGUs with access	3.9%	4.8%	8.0%	9.4%	14.0%	15.17%	17.93%	21.78%

Source: NSWMC 2018

The study sites showed a closer depiction of this compliance. For instance, Quezon City, despite being an HUC, has low compliance in terms of establishing MRFs with only 36 out of 142 barangays managing to establish their own facility. As for Rizal, there were 148 fully operational MRFs[14] in 189 barangays as of November 2019. The other 30 barangays have partially operational facilities, four with non-functional ones, and the remaining had no existing MRF. Bulacan managed to have 50 percent of its barangays construct MRFs in addition to 44 composting facilities. In contrast, the City of San Fernando alone reported a total of 162 operational MRFs run by both barangays and private contractors. These facilities were designed based on local demographics with MRF capacity ranging from 0.5 to 2.0 tons per day. The Pampanga LGU also stepped in by establishing municipal MRFs when barangays were unable to establish their own.

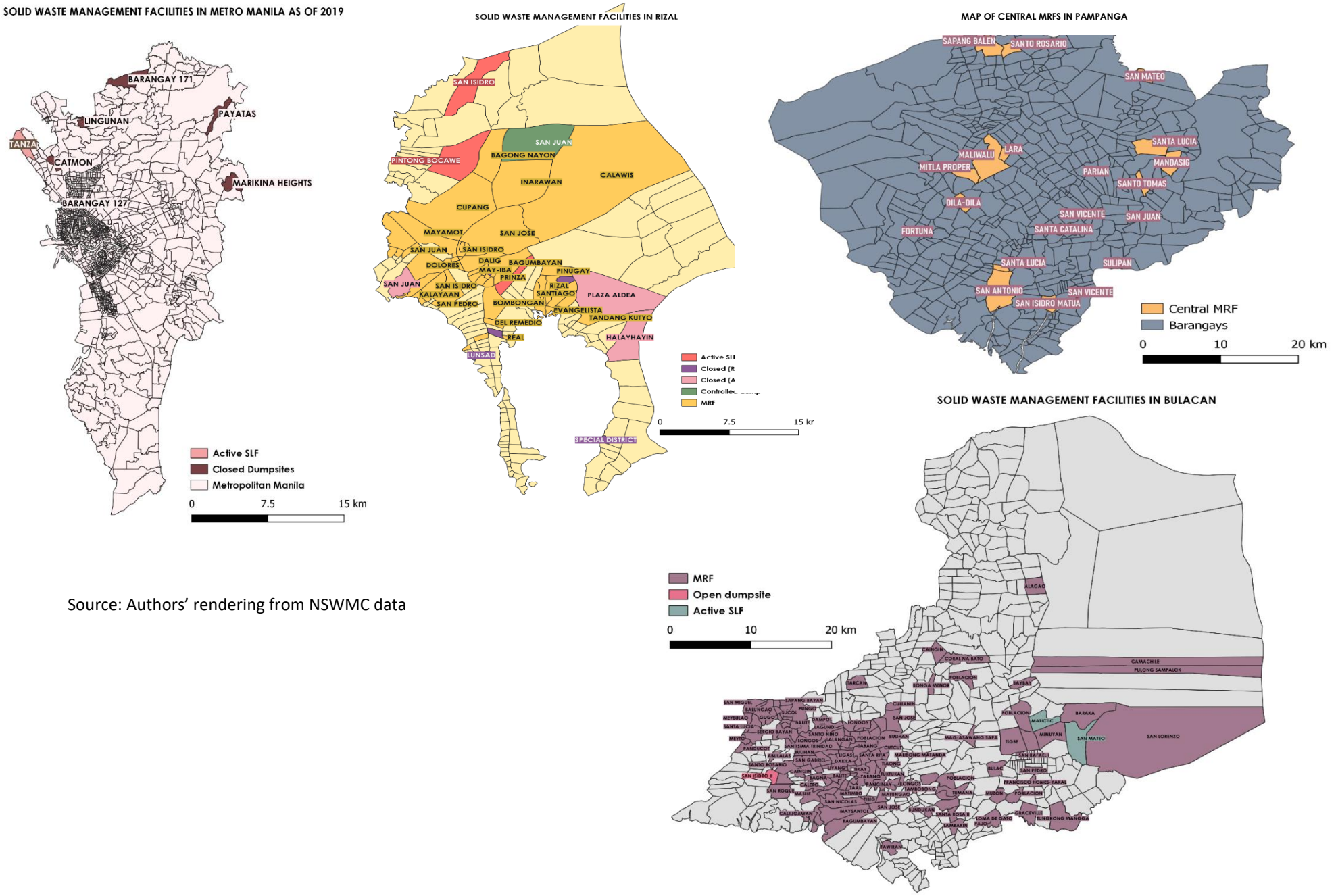
Figure 8. Trend of material recovery facility across regions from 2008-2015



Source: NSWMC 2018

[14] The Rizal PLGU has the full criteria for a fully operational MRF containing the following: receiving/sorting area, at least 6 segregation bins with complete labeling, composting facility, eco garden, waste diversion, and clean and orderly surroundings.

Figure 9. Solid waste management facilities in Metro Manila, Rizal, Bulacan, and Pampanga



Source: Authors' rendering from NSWMC data

5. Case studies

5.1. Collection

With the profile of generated wastes, and available SWM facilities already presented, the following discussion focus on adopted SWM systems at both the province and the municipality levels. Waste collection was generally observed to have better turnouts in urban areas compared to rural ones. This difference was attributed across study sites to the absence of organized collection schemes, non-cooperation by residents, unfit collection vehicles, and ineffective routes of collection service.

Barangays handled responsibility related to waste segregation and collection, mostly implementing a no-segregation, no-collection policy in line with scheduling mechanisms. Households were given the responsibility to segregate their generated wastes and prepare them for eventual pick-up or transport to collection hubs. Material recovery facilities also provided a second layer of segregation. In areas inaccessible by large trucks, mini-dump trucks and pushcarts were utilized. In big localities, private contractors were given full responsibilities to carry out not only the disposal but the collection and segregation components as well.

Municipalities were left in charge of special and hazardous wastes. It was expected for these wastes to have specialized collection and transport vehicles. CSFP particularly delegated its collection responsibilities. Private contractors were in charge of residential wastes, City General Services for SMEs, and private handlers for large businesses. However, segregated wastes sometimes get mixed with other wastes in open dumps, defeating the purpose of material segregation. A good practice was Quezon City's macro and micro cell-based collection system among its residential and commercial areas, which gave more responsibility to both households and commercial establishments in managing their respective wastes. Informal workers also played their part in material collection, buying and selling recoverable materials from households to local junk shops.

It was apparent that although much responsibility was expected from the barangay level, limitations in resources made them dependent on municipal initiatives. Funding for waste collection equipment, wages of personnel, and the establishment of MRFs most often came from the city/municipal governments. This resource inequity and LGU dependence need to be rectified if localities are to see more effective and responsive collection and material segregation systems.

5.2. Processing

The informal economy played a prominent role in the solid waste processing phase as it bridged the gaps across material collection, segregation, and recycling. Junkshops served as pseudo-MRFs, and scavengers and street collectors picked recyclables for their market value. Quezon City acknowledged how big the contribution of their 91,983 waste pickers was, making efforts to institutionalize them in their SWM system a natural course to take. The city government was in the same boat as other highly urbanized cities where, oftentimes, scavengers have taken the responsibility and earning opportunity in waste material recovery.

The processing of reusable and recyclable materials, including paper, glass, plastic and metal, added a flavor of sustainability in SWM. The table below presented diverted materials as collected by different actors in the system. Across all materials, it was evident that disposal site scavengers perform much of the collection tasks, albeit informally in most cases. Protecting

informal workers welfare may not only benefit the community, but it could also contribute to operational viability of local SWM programs.

Table 6. Wastes (kg/capita/day) diverted from major locations, disaggregated by material and collector

Material	Collector	Metro Manila	Metro Cebu	Southern Mindanao	Average
Paper	Street collectors	3.18	3.69	2.45	3.11
Paper	Collection workers	21.83	1.81	0.62	8.09
Paper	Disposal site scavengers	22.01	8.21	12.86	14.36
Aluminum	Street collectors	0.76	0.35	0.40	0.50
Aluminum	Collection workers	0.78	0.13	0.02	0.31
Aluminum	Disposal site scavengers	2.50	0.05	1.79	1.45
Other metals	Street collectors	1.39	5.04	14.76	7.06
Other metals	Collection workers	12.35	0.94	0.64	4.64
Other metals	Disposal site scavengers	16.75	6.34	13.75	12.28
Plastic	Street collectors	1.63	3.94	3.50	3.02
Plastic	Collection workers	9.79	0.50	0.63	3.64
Plastic	Disposal site scavengers	20.32	4.48	25.00	16.60
Glass	Street collectors	0.85	0.58	6.65	2.69
Glass	Collection workers	6.58	0.26	0.94	2.59
Glass	Disposal site scavengers	9.96	0.32	49.64	19.97

Source: JICA 2008

On the other hand, Rizal, CSFP, and Bulacan explored the market and exchange domain for wastes. Rizal saw junkshop owners as markets for recyclable wastes, the revenues for which were given as allowances to eco boys who collected in inaccessible barangays. CSFP engaged junkshops with private sector through Waste Market Fairs wherein residents brought recovered material in exchange for cash or bartered goods, an exchange program also found in Bulacan.

The former model from Quezon City should be looked into by other LGUs. While informal participants were still considered present in the mechanism, greater benefits can be realized, especially in monitoring and regulations, when they become institutionalized.

As for biodegradables, composting arrangements with countryside grazers were seen as a viable option. CSFP converted their average 2 tons of daily waste into soil enhancer or conditioner to be sold to agricultural cooperatives, ornamental, and vegetable growers, and households across regions.

Meanwhile, residual wastes, the type of wastes only accepted by sanitary landfills, were diverted using innovative methods in partnership with economic industries of each area. Teresa, Rizal converted its open dumpsite to a central facility, or better known as the ISWMF, into a package of MRF, interim composting, and recycling. It produced construction materials,

paper charcoals, pillows and cushion fillings, and coco nets from residuals. The latest venture came about due to the concentration of quarry operations and mining rehabilitations in Teresa.

Because of the coincidence in needs, the LGU struck a direct market for their produce; this also helped sustain the livelihood of the community workers. Thirty rolls of coco net can amount to Php 75,000, the sales of which were directed to be wages of the workers who were mostly females and members of the cooperatives. Based on the interviews during field visit, the workers for the coco nets earned a daily net of Php 150 – a long way from the previous Php 10 and Php 55 wages.

CSFP resembled more the case of Teresa wherein they converted the open dumpsite into a City Disposal Facility. The dumpsite's closure led to the thinning out of scavengers in the area who were compensated with either the Balik Probinsya program or livelihood options. However, the city did not have a comprehensive livelihood system within the facility unlike Teresa.

Private sector engagement was also notably prevalent in Pampanga, particularly in marketing and information campaigns. Pasalubong centers have been utilized by CSFP as the one-stop shop for all recycled products e.g. locally-made organic fertilizer, pavement blocks, and plant pots. Malls hosted waste market fairs to facilitate drop off and buy back mechanisms for recyclable wastes. Cement manufacturers, Republic Cement and Holcim Geocycle Philippines, exchanged five to cement bags to LGUs for every one ton of shredded plastic waste. Further, the city LGU made great use of its local networks – CLTV-36 and GNNTV 44 – as medium for infomercials and live TV shows on proper segregation.

5.3. Disposal

A caveat was given in the legal transition process as provided for by the policy, in such that the formulation should be guided at all times by a city or municipality, citizen, communities, business establishments, and other key stakeholders to allow for a strong social contract between municipality and community (NSWMC & JICA 2010, Hoornweg & Perinaz 2012).

It was believed that the incidents revolving Payatas dumpsite served as catalyst for the passage of RA 9003. Due to the ire and feedbacks from the general public, this was immediately closed down and shifted into a controlled dump[15] from 2004 to 2007 (Ofreneo 2012). It was soon converted into a 3.2 ha sanitary landfill in 2010. The average waste generated was measured at 1,320.90 tons per day while the diverted waste was estimated to be around 1,317.92 tons per day. The SLF was supposed to operate for a decade, but it was stopped in 2017 upon reaching full capacity. The city now depended on the SLF located in Rodriguez, Rizal. Other LGUs have shifted to the remaining active SLF located in Brgy. Tanza of Navotas or to Carmona in Cavite, and San Mateo in Rizal.

The forced closure of Payatas SLF gave way to the Payatas Biogas Emission Reduction Project[16] in partnership with Pangaea Green S.r.l. (Italy) and Pangaea Green Philippines, Inc. in an attempt to optimize the benefits of the carbon credit market as one of the Clean Development Mechanisms. It was planned to be divided into two phases: the first part being the construction of the biogas extraction system while the second part was the utilization of methane-generated electricity to provide energy to surrounding communities. The output was

[15] Controlled dump is defined by the Global Development Research Center (GDRC) as a transitory phase from open dumpsite to sanitary landfill where some features of the latter are put into place. The controlled dump phase ushers in aspects of control over the previously free rein operations of open dump (GDRC n.d.).

[16] The waste underneath apparently amounted to one million metric tons, producing methane as by-products; the project aimed to extract these emissions through 87 wells and convert these into electricity.

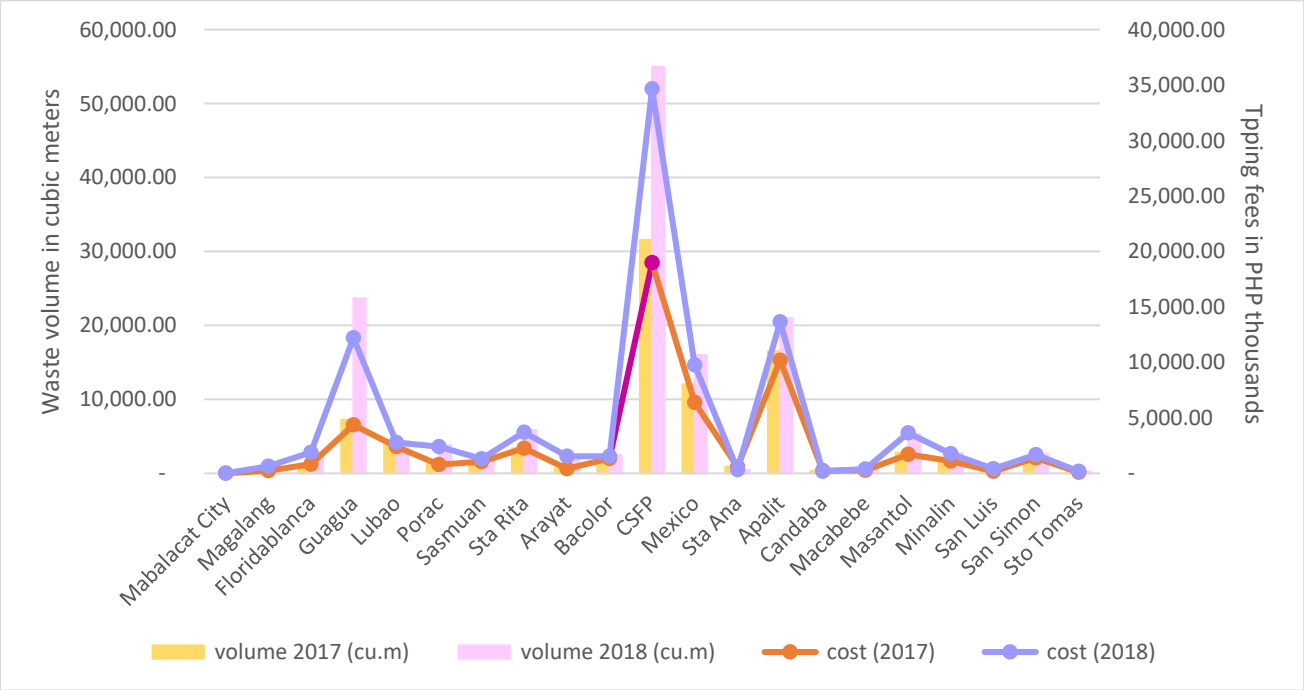
to fuel the Refuse-derived fuel (RDF) project, but this did not come to fruition due to logistical limitations – one of which was the constrained market prices offered by Kyoto Protocol.

Paombong, Bulacan also had an open dumpsite which continued to operate even after the closure mandate espoused by RA 9003, pushing the EMB task force to elevate it into an ombudsman case in 2017. The municipal government had to conduct the rehabilitation until 2018, transitioning into a controlled dumpsite through a prescribed safe closure plan. This was eventually converted into an ecopark like in the case of Payatas.

It was not uncommon in the Philippines to cluster landfills due to inherent area limitations. As brought up earlier, Rizal province has three SLFs located in Montalban, San Mateo, and Morong which serviced Metro Manila and Central Luzon. The latter region previously had three SLFs in Viray, Del Monte, and Wacoman in Norzagaray. The last one recently closed despite not reaching its maximum capacity due to the boundary and fiscal disputes among three LGUs surrounding the facility. Bulacan and Pampanga both entered into an agreement with Metro Clark Waste Management Corporation (MCMWMC) to transfer their wastes to the landfill site in Barangay Cutcut II, Capas, Tarlac.

One aspect not usually highlighted in the matter of SLF clustering was the cost. In the case of Pampanga LGUs, their hauling costs and tipping fees to MCMWC averaged around Php 660 per metric ton. Government fund sources can only do so much until they all start to thin out, and LGUs would have to look elsewhere for fund augmentations or at the most, technology changes. There was a proposal in 2018 to construct a Category 4 SLF to lessen the costs being incurred by local governments, however it met resistance from stakeholders and did not further progress. This particular contract would have lasted for 25 years with a maximum capacity of 20 million tons and operational capacity of 1,000-3,000 tons daily.

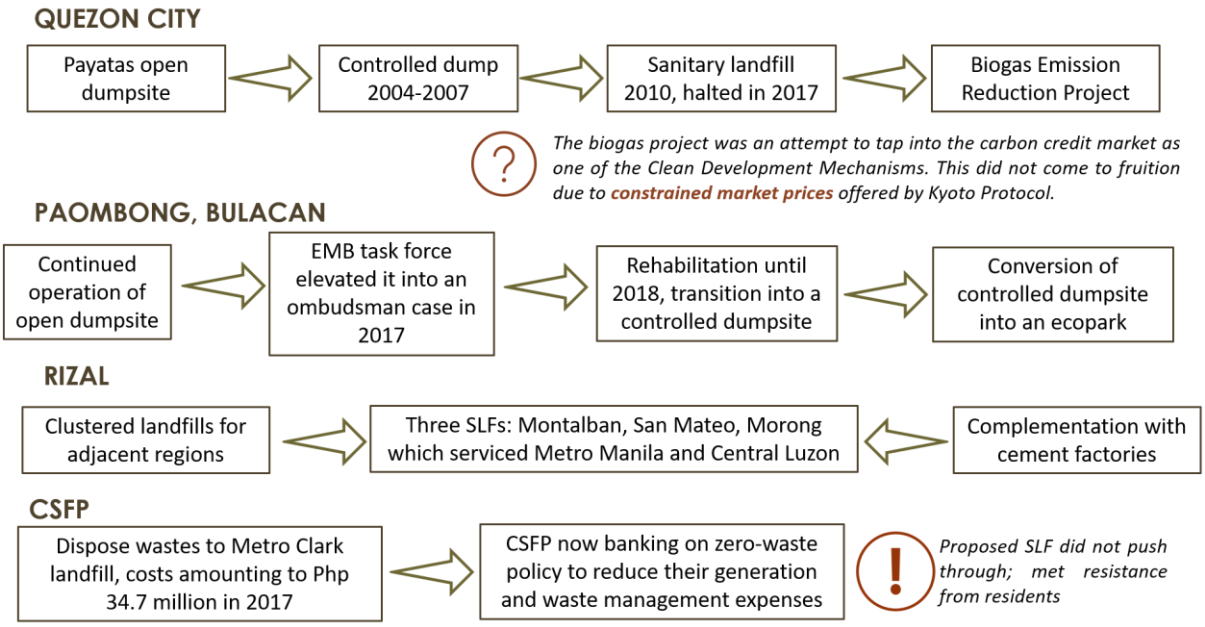
Figure 10. Waste volume disposed to MSWMC and tipping expenses of Pampanga LGUs for 2017 and 2018



Source: Pampanga PG-ENRO 2020

The figure below summarized the disposal conditions for each of the case study. Some of the areas posed replicable examples of waste management while others illustrated perennial concerns. Ultimately, these discussions all boiled down to the observation that while solid waste management has improved since the passage of RA 9003, improvements remain wanting to reach even the basic goals prescribed by its provisions.

Figure 11. Summary of disposal conditions across study sites



Source: Authors' analysis

5.4. Waste management in the time of COVID19

Not included in these components was the handling and treatment of hazardous wastes, but this discussion was particularly timely due to the ongoing pandemic. The Philippines had its first declared COVID19 case in January of this year. The cases spiked by March, overwhelming the health sector, and ultimately becoming the catalyst for nationwide lockdowns. Government hospitals have taken the brunt of the cases, but interestingly, they were not considered within the jurisdiction of local governments nor were they mentioned among the provisions of RA 9003. This was because they have a separate policy that govern the whole operations – Republic Act 6969 or the Toxic Substances, Hazardous, and Nuclear Wastes Control Act – wherein all hazardous wastes were to be handled by specialized containers, go through waste treatments (e.g. autoclave, pyrolysis), and disposed in dedicated cells within a landfill.

The surge of COVID19 cases meant a spike in hazardous wastes. For instance, the San Lazaro Hospital in Manila City released between March and June approximately 29,473 kilograms of healthcare waste including but not limited to "personal protective equipment, dressings, swabs, blood bags, urine bags, sputum cups, syringes, test tubes, and histopathological waste." These figures were expected to further increase in the coming months with no end to the cases. Earlier in April, the Asian Development Bank projected Metro Manila would generate 280 MT of healthcare wastes per day. This was from the pre-COVID baseline figure of 47 MT – roughly equivalent to 600 percent increase in waste generation (Cabico 2020).

However, the guidelines in RA 9003 were not able to consider the surge in household generation of face masks, face shield, and even PPE. The management of healthcare wastes among households were unfortunately not tackled within the policy.

Local governments also surmised shifts in generation patterns. While overall generation decreased significantly as a result of establishments shutting down and limited foot traffic, the share of special wastes increased. It could also be posited that plastic generation may have gone up due to the increase in food delivery services and online shopping. Conduct of WACS can validate these hypotheses (Escovilla 2020).

5.5. Penalties and incentives

To keep overall compliance in check in subnational levels, penal provisions and incentive schemes have been laid out together to form complementary negative and positive reinforcements. Among this study's case sites, Rizal has the strongest incentive mechanisms. For the provincial government, this involved quick facilitation of requests and provision of equipment necessary for solid waste management like e-bikes, green vehicles, and dump trucks. Cash incentives and equipment were also given to barangays with best practices courtesy of the YES Team, and the Barangay Resilience Award from the provincial DRRMO. The prizes for these amounted to a total of Php 21.26 Million. Bulacan followed the trend of most LGUs pooling in SWM as one of the criteria for its model community awards. For instance, Gawad Galing Barangay recognized best waste practices as one of the judging criteria. This was similarly followed by *Kalinisan at Kaisahan ng Kapaligiran (KKK)*.

Pampanga deviated here as its programs were particularly specific to SWM. It involved jingle making and slogan making contests on waste management topics, and the usual year-end awards like Best Barangay, highest diversion rate, best MRF, best IEC, and clean and litter free barangay. Cash dole out was also observed by CSFP, providing Php 150,000 to compliant barangays to augment MRF construction cost, and Php 50,000 worth of construction materials to Household Owners Associations (HOA). Apart from cash prizes, equipment were also provided to compliant areas. Resource augmentation was likewise extended by the PLGU as it recognized the limitations of some LGUs in the fiscal aspect. As for Quezon City, it passed Ordinance No. 1203 in 2002 to provide equipment and grants to barangays with best SWM practices.

Hand in hand with incentive mechanisms were disincentive mechanisms aimed to provide a semblance of 'teeth' to policy implementation. Barangays which were not able to establish MRFs have their requests and permits on hold by the provincial capitol. These will not be entertained until such time that they will be able to process for one. Further, LGUs often left the enforcement measures to EMB as it was in their capacity to file cases against local government leaders in violation of SWM mandates.

5.6. Future initiatives and strategies

5.6.1. Technology proposals

Waste generation would still continue to rise alongside population growth, and in-migration, and there would be a need to combat this more effectively. Using status quo mechanisms to address waste management concerns would not be viable in the long run; hence, these are expected to evolve over time, utilizing available technology and innovations.

Accumulated wastes in landfills would eventually produce landfill gases, and the most common method to extract these was to convert them into fuel or energy that could help sustain landfill

operations and provide supporting revenue to the hosting LGU. This was recently considered by the local government of Quezon City for the Payatas landfill. However, establishing flaring systems was deemed beyond the capacity of local governments. It would be ideal to establish it with a multistakeholder collaboration from public and private actors (Markgraf & Kaza 2016).

Another popular technology widely considered by the study sites was incineration[17] . While this was explicitly prohibited, waste-to-energy facilities and technology were observed to be aggressively promoted in response to the mounting wastes, especially hazardous ones during a pandemic.

The cement companies in Rizal province use the WTE mechanism where heat can be used to power turbines for electricity. The collected residual wastes[18] from the municipalities were provided to their factories (Republic Cement Corporation) to serve as alternative fuel under certain conditions. Teresa, the main supplier, was required to produce two tons of segregated residual waste per day, but this target was not realized after an initial try. They compromised to deliver every two weeks instead to meet the minimum weight. The gathered waste was sold at Php 1.20 per kilo or Php 1,200 per ton.

The other type being considered was the refuse-derived-fuel (RDF) which was the model for Quezon City; in this model, the waste is turned first into fuel before being incinerated (Roberts-Davis & Guerrero 2018). The LGUs believed they did not violate prohibitions as there was a grey area in temperatures.

Another incineration proposal was recently pushed in the Mindanao region. The Davao City government in 2018 was in the process of finalizing the location for a Php 2.5 billion Japanese-funded waste-to-energy project to be built in the next three to five years. The necessity was caused by the almost-full SLF in New Carmen, Tugbok which has been functioning for only eight years[19] (Colina IV 2018). This move was met with a lot of resistance from not only the general public but environmental advocates and NGOs as well.

The Philippines was not the only country experiencing land shortage concerns in relation to landfill spaces. It was, and still is, an emerging concern among small developing countries in the Southeast Asia region, especially agricultural-based economies. Landfills have been found to fill faster than their expected shelf life, and source reduction strategies have barely mitigated these. It has not been much of a surprise then when countries which have predominantly organics and biodegradables in their waste composition would consider incineration and waste to energy alternatives.

In the case of Malaysia, they did not have blanket banning of all forms of incineration and WTE. A small-scale incineration plant was established in 2011 in the touristy Tioman Island under the direct lead of Tioman Development Authority. It was discontinued later on due to high MOOE from high moisture content of wastes fed into the plant. From this, their government entertained several large-scale, centralized projects, particularly concentrating on urban areas, but these did not come to light due to public resistance as well as lack of financial capacity for maintenance costs (Abd Kadir et al. 2013).

[17] The European Commission defined a waste incineration plant as any stationary or mobile unit and/or equipment in charge of conducting thermal treatment of wastes with or without recovery of the combustion heat. The objective of such process is to reduce the waste into ash or slag before disposing it into a landfill.
[18] The residual wastes were responsible for the 30 percent share of the province's total waste.
[19] Life span of a sanitary landfill is up to 25 years as indicated by NSWMC

In other countries, incineration was present through healthcare wastes. Laos apparently opted initially for this technology but was subsequently met with financial constraints. Indonesia, on the other hand, provided benchmark emission values for their existing biomass-fueled incineration plants while Vietnam opted for a treatment infrastructure sponsored by World Bank and Germany. While these countries were able to establish incineration systems, they have pushed for the adoption of other low-cost, treatment options like autoclave systems (Kuhling & Pieper 2012).

Singapore's case might be worth looking into since it has managed the coexistence of landfills and incineration towards the realization of their becoming a Zero Waste Nation. Over the years, the state has been able to establish five incineration plants with only four operating right now. The technology was utilized early on in 1970s, concentrating on mass burn incineration that provided them a 90-percent reduction in waste and electricity generation. Waste collection has been completely privatized in the 1990s, but for its disposal and treatment, the country took on a public-private partnership approach between Keppel Seghers and the National Environment Agency through a Design-Build-Own-Operate (DBOO) scheme. The government assumed a take-or-pay agreement with the developer and were to bear the risks of the full payment regarding the realized utilization effectivity of the plant. This has been possible due to the waste composition itself of Singapore. Food and other organics were not their top compositions but construction and demolition (at 1.4M tonnes) and ferrous metal (1.3M tonnes) (NEA 2019). They also have the fiscal resources to back these capital outlays.

To fully allow incineration and all its forms, the Congress must repeal the two landmark policies (Clean Air Act and Ecological SWM Act). It sought to do this through House Bill No. 2286 which contained a provision erasing the ban. Its micro-solution for now is through conditional advisories and bypassing the law. The most recent issuance was an EMB Memorandum dated on March 26, 2020 allowing use of incinerators and crematories for healthcare wastes as alternative modes of disposal (Biong 2020).

As for bypassing, DENR Undersecretary Jonas Leones stated in one article that there was a 2002 Supreme Court resolution that allowed forms of incineration compliant with emission standards or in other words, burning processes which do not emit poisonous and toxic fumes (Teves 2019). This was likewise echoed by one of the informants on the ground since WTE plants and cement manufacturers used temperatures way above the usual incineration plant, thereby avoiding harmful emissions.

Environmentalists have persistently countered these proposals based on the large body of literature with findings cancelling out the benefits of incineration, among these included the unsustainability of the technology, health and environmental hazards, and its deviation from renewable energy. For a plant to be economically viable, it should at least be able to process 150,000 tons of waste per year (Themelis et al. 2013). Plastics demand may replace larger portions of landfill with incineration and drive cumulative CO2 emissions higher, equating to approximately more than a third of the global carbon budget (Material Economics 2018; Zero Waste Alliance n.d.). The bottom-line from the environmentalists' perspective is that incineration encourages extraction and depletion of resources.

Avenues for compromise can be identified in the previous cases presented. Should Philippines continue to pursue its legalization of incineration, it should agree on establishing emission level limitations cognizant of global standards, strict set of environment conditionalities, and a well-equipped adequate monitoring body. Technology may be critical in designing incinerators fit

for the country's waste composition[20] and cost-effective as well to balance maintenance costs and public welfare.

While proposals above were largely welcomed, Kaza et al. (2018) supported veering away from the argument that technology was the only solution to global waste problem. A more effective approach would be to discover and formulate solutions fitted according to local needs and constraints.

5.6.2. Strategies

True to Kaza et. al's words, local governments have formed their respective strategies for waste management. For Quezon City, this meant integrating the informal economy to the system, solving not only the problem of in-migration but also the livelihood generation.

For Rizal, the approach was towards policy to force compliance with waste generation. Despite the strong call for a province-wide single-use plastic ban, the local government has to consider their established linkages with cement factories[21] since plastics were significant sources of residual wastes for WTE. Another policy direction being considered by Rizal was the stricter requirement of environmental fees and permits to commercial establishments. Monitoring of water quality was also planned to be reviewed and adjusted, probably due to their commitment to the Manila Bay rehabilitation.

The provincial governments of Bulacan and Pampanga were more concerned with strengthening their respective information and education campaigns, but the former LGU needed to extend more efforts in engaging with its private counterparts. While solid waste management was considered as part of the PLGU's People's Agenda, this prioritization did not manifest clearly on the ground.

In the national level, the most daunting initiative that the NSWMC rolled out was the Green Procurement Program which was institutionalized through Executive Order No. 301 in 2004, and eco-labeling. It also established Resolution No. 60 in 2013 among the LGUs with recommendatory measures to segregate at source. As aforementioned above, the study sites had their respective strategies on waste management anchored on their unique enabling conditions and resources, but this can be considered as reactive at best towards the current problems the LGUs were facing.

6. Thematic analysis

6.1. Influence and involvement

It was not surprising to find local politics at play in solid waste management discussions across the study sites since local chief executives and their focal people usually had the first and last say on directional priorities and strategies, and funded programs projects and activities. But both top-down and bottom-up approaches were observed across the case sites with concrete evidences of reinforceable and replicable vertical linkages.

Municipal-led policy influences were more visible in Rizal, where initiatives from the municipality of Teresa eventually found appreciation from adjacent municipalities, cities and provincial governments. On the other hand, a more top down cascade of policy and structural reforms was exhibited in Pampanga, with linkages extending beyond local government networks across private and non-government agencies and community-based organizations.

[20] One example would be biomass-fueled incinerators that are tweaked to be able to process wastes with high moisture content.
[21] It was mentioned during interviews that EMB provided clearance for the operations of cement factories. The bureau maintained a consistent monitoring schedule with regards to their emissions.

The extension of influence from strong vertical and horizontal connections enabled the grounding of policy and optimal use of resources, especially in enforcing the mandated SWM facility compliance, cultural transformation, and information and education communication campaigns in the province. However, local government leaders were also seen as both facilitators and impediments in the scheme of things. There were echoing issues on consistency and continuity concerning changes in political leadership and administration priorities, resource and logistical arrangements, and arbitrary decision-making.

This was especially felt by Quezon City's implementing division, Environmental Protection and Waste Management Department (EPWMD), which experienced institutional makeovers with the changes in local government leadership. Having recently returned to a familiar political steward, the EPWMD faced more reorganization prospects in line with current requirements and the incumbent's priorities.

6.2. Community engagement, and initiative

For waste management systems to operate effectively, community and stakeholder education, cooperation and engagement must be ensured. A common way to foster understanding and commitment is through information, education and communication (IEC) campaigns. IEC is a core component of SWM, it being integral to promoting desired behavioral changes and informed action within households and communities. As such, campaigns must be appropriate to target audiences and should exhibit consistency in message, timing of delivery, and follow through of the learnings.

Grounding of waste management policy provisions from the end of the government is difficult with passive public engagement. Across study sites, people were enjoined to become participants in various activities (i.e. clean-up drives, brigada eskwela), while private entities were motivated to go beyond their responsibilities as business establishments and service providers with a conscientious take on lessening their carbon footprints. But there was not much mention on how stakeholders were involved in decision-making, crafting of policy and overall implementation, pointing primarily to a top-down approach in SWM.

6.3. Challenges in implementation

The situation on solid waste management in the country is far from ideal with the NSWMC identified four administrative concerns that hinder effective implementation of waste management systems in place which ultimately spilled over across technical support[22], financial, and institutional[23] structure.

The many mandates and functions of the oversight body in solid waste management were listed earlier, but only few of these were met by its capacity. While NSWMC arguably performed well in information and education campaigns, and initiatives with private sector, it fell short in its vital function to assist and create an enabling environment for policy implementation. The body did not formulate a technical and capability building program that was handed over to the subnational levels to aid in source reduction nor was there a concrete program to link recycled products to markets. With this, they also failed to create safety nets and alternative livelihood programs for the informal economy that would be displaced by facilities.

[22] Technical support was defined by the report as any activity involving active communication on technical and values capacities in SWM formulation.
[23] Institutional structure, on the other hand, pertains to the commitment of internal and external stakeholders.

Apart from its functional lapses, its ex officio nature exhibited inherent institutional gaps like limited staffing and interface beyond annual meetings. It was for this reason that the reconfiguration of NSWMC was being considered as part of augmentation.

The administrative concerns rooted in these gaps manifest themselves in the approval rate of SWM plans. The oversight agency admits that there was quite a backlog in the approval of these plans, usually followed with a remark on financial and labor constraints. This is further compounded with issues on data sharing from external bodies; it is necessary for implementing bodies to receive analyses of information to better inform next strategies. The absence of what seems to be the blueprint of implementation of the local levels could cause domino effects. Further, alignment was not assured between PDPFP and the development plans of municipal/city LGUs.

The low compliance in the implementation of SWM plans among local levels were still evident, especially in mainstreaming these mechanisms to the existing planning frameworks of these areas. This could root from a variety of reasons like lack and breakdown of communication, non-pursuit of commitments, low technical and managerial skills, poor and ineffective enforcing mechanisms, and absence of accountability from upper and national level agencies (Christie et al. 2005, Larsen et al. 2011, Lowry et al. 2005, Gamaralalage, Gilby, & Lee 2015). Other factors include the political exigency of local chief executive, weak monitoring and evaluation mechanisms, and the absence of teeth and clout by LGUs and EMB to violators.

Without a rationalized system in place, penalties are more likely to be foregone and mandates ignored. The report echoes this in the following statement, "Enforcement provides the 'stick' in the carrot-and-stick policy to motivate implementers to do their work in timely and technically sound ways. Regular monitoring and evaluation also improve the management cycle through proactive responses." (EMB-SWMD 2016, p. 3) Personnel enlisted in the field became the collateral of such weak institutional structures. They rarely have hazard pay nor are they given plantilla positions.

In line with penal procedures, it was also apparent that there was a lack of transparency. NSWMC had a greater role at play here as it was well within their mandate to pursue violators, but they acted as external parties instead with absent enforcing duties**.** This should be addressed soon by both national and local institutions as this was identified as one of the consistent weaknesses of the policy on the ground. The same transparency was not afforded to the pursuit of suitable technology to counter increasing wastes.

Mounting waste concerns will be much more unmanageable when the minimal facilities present in the country can no longer absorb beyond their capacity. LGUs do not also have the fund to maintain sanitary landfills and adopt new technology. Ultimately, brunt of the impacts will be shouldered by poor communities and the informal economy.

Local governments were well-acquainted in interfacing with the informal sector, and by association, the informal settlers, especially those within cities and urban-adjacent municipalities. While invisible in official demographics and statistics, scavenging is a common livelihood for the urban poor in low- and middle-income countries. They are usually women, children, elderly, unemployed or migrants. They are not covered by any health insurance, but their environment is characterized with unsafe conditions. Migration may be deemed as inevitable, but there would be lag effects in shifting their previous mindsets and culture towards the already existing mechanism in the LGU. Naturally, the goal of any country with such sector

is to formalize it to mitigate, if not alleviate poverty, as well as improve waste collection and recycling.

6.4. Streamlining policy

Developing countries, like the Philippines, suffer with the existence of weak regulatory governance structures, and absence of necessary technical resources and infrastructures that are vital for monitoring and assessing operators of waste facilities. These are oftentimes marked with inefficient waste segregation and collection systems, limited public money, and large populations of informal waste workers (Roberts-Davis & Guerrero 2018). As if to harmonize with the absence of regulatory structures, the same developing countries also lack the suitable policy framework that could help them address higher approaches in the waste hierarchy. These put them into a disadvantage against the global progression of waste generation and urban population growth.

The baseline policy that ties all the components of solid waste management together is relatively good and adept however, like any other law, it has loopholes that need augmenting. In particular, the implementation fell short of what was expected. Many primary mandates espoused by RA 9003 were not cascaded to local implementors, among which included the foreclosure, institutional oversight, and compliance with prohibitions. For one, illegal dumpsites should have been phased out many years ago, but there were still a number of LGUs unable to shift to open dumpsites, albeit not a fault of their own but just inherent limitations.

Moreover, as the LGUs were considered to be at the forefront of services, they were expected to have firsthand knowledge on their respective waste profiles and strategies on top of other overlapping responsibilities. A more visible role in the formulation of solid waste management plans should have facilitated LGUs in discovering system gaps and mobilizing improvements.

These limitations were aggravated by the shortcomings of NSWMC as the facilitator to local governments; as such, the absence of programs also hindered improvements in the landscape and pushed LGUs to practice full autonomy on their use of ingenuity – thus came the presence of WTE technology, which in all actuality, was a form of the prohibited incineration.

In terms of amending RA 9003, most national and local agencies have been considering eliminating the prohibitive provisions on incineration as what was discussed above. For NGOs like MEF, it meant reinforcing the ecological aspect of the policy and meeting what is required of them like the list of non-environmental acceptable products (NEAP) wherein NSWMC stated that, “No product has yet been determined as non-environmentally acceptable.” (NSWMC 2018, p. 7). These two future initiatives seem contradictory in nature.

It was ironic that the policy itself limited the technology available for SWM mechanisms. It imposed the use of ‘ecological solid waste management’ on a country which had limited resources to create and establish environmentally sustainable facilities. The policy was devolved to the LGUs, but the mere succession of the LGU does not ensure continuity of the initiatives. The barangays also do not have well-defined responsibilities as per the informant. This is contrary to the provisions in the IRR of RA 9003.

Institutional and bureaucratic blockages were also observed to manifest between national and local governments. For instance, one by-product was the heavy dependence of barangays to their respective cities and municipalities as in the case of Quezon City. While most waste mechanisms are executed at the municipal and barangay levels, it is pertinent that the national government should issue directives and goals that are achievable and supportive to them (Kaza,

Yao, and Stowell 2016). Further, to bolster the expected bottom-up approach in the implementation process, there is a need to strengthen capacity and resource in the vertical linkages of involved institutions.

7. Ways Forward

The most recent comprehensive report generated by the NSWMC was released in late December 2015 based on 2013 data. There needs to be a more current appraisal of the sources, composition and volume generation projection of solid wastes in the country. Both national government agencies and local government units will be more effective if they have access to reliable and current data and information. Data must also be disaggregated sub nationally to better inform LGUs in their planning and decision-making activities.

Almost two decades after the passage of RA 9003, the country is still grappling with solid waste management issues. This is substantiated by evidences on the ground pointing to the weak aspects of policy grounding with illegal dumpsites remaining despite the supposed forced transition to engineered sanitary landfills. This apparent setback is an entry point for intervention.

One concern revolves around available investment and financial resources among LGUs. It was recognized that local chief executives were integral in prioritizing solid waste management in their administrative plans, but much of the implementation burden also fell on focal persons from various bodies and task forces. Unfortunately, the policy did not explicitly identify a working body alongside subnational waste committees, hence the NSWMC recommended in its status report the immediate institutionalization of municipal/city ENROs. In addition, most LGUs cannot depend on their share from IRA alone for the establishment of multi-million waste facilities. Other possible resource augmentation avenues must be explored, including but not limited to national to local transfers, aggregate arrangement between and among LGUs akin to landfill clustering, and public-private sector arrangements. Oversight agencies can also connect with funding institutions to extend loans, and with DILG and DENR providing trainings on the various dimensions of SWM, including market access for recovered materials and by-products.

The Mandanas ruling[24] may also reshape the fiscal landscape of local governments once it takes effect in 2022, although local governments are expected to assume additional devolved responsibilities (Gonzales 2020). The wider fund base may not fully bridge the gaps in local development services especially when there are no clear guidelines yet on how to manage the additional funds given additional devolved functions, and disbursement mechanisms. But if local governments are given full discretion in fund utilization, there would be opportunities to fill in identified infrastructures and capacities needs sub nationally and the Mandanas ruling may be able to partly provide the fiscal space needed for waste management facilities. On the downside, local governments may again face the problems of human resource limitations, particularly with functional add-ons. The preparation period until the full implementation of the Mandanas ruling should allow time to plan for projected changes and human capital augmentations.

[24] The Mandanas Supreme Court ruling expanded the IRA base of LGUs by including the following national taxes: (a) national internal revenue taxes as stated in Section 21 of National Internal Revenue Code, (b) tariff and customs duties, (c) 50 percent of value added taxes, and 30 percent of other national taxes in BARRM, (d) 60 percent of the taxes generated from exploitation of resources, (e) 85 percent of excise taxes from tobacco products, (f) 50 percent of taxes collected under Sections 106, 108, 116 under NIRC, and (g) five percent of the 25 franchise taxes.

Effective solid waste management needs whole of government, whole of society approach as both institutions and communities are affected and involved. While local administrations are not new to external collaborative work, interfacing with CSOs and the private sector improves LGU access to substantial networks and assets outside government. Enhanced policy compliance can be exacted through stakeholder ownership on one part, and enforced accountability on the other.

Technology application, industry linkage, and self-sustaining SWM operation must be pursued. Implementors can decide on a state-of the art landfill facility and SWM technology with a viable IGP component to sustain the local area operations. The same will aid in the institutionalization process for the informal economy surrounding waste management operations in the country.

The NSWMC's attempt at a wider application of the polluters-pay principle, as well as incentivizing policy compliance must be supported, as these are also sensible recommendations from CSOs including GAIA and MEF. Incentive mechanisms must improve and encourage compliance, and strengthen and complement existing SWM schemes on material reduction, reuse and recycling. Penalties and sanctions for violators must be made more felt and visible to facilitate enforcement at the subnational level.

Waste reduction strategies were found weak, if not lacking, across study sites. Waste generation must be tempered particularly among households and institutional stakeholders as they are the biggest contributor volume-wise. Value reorientation toward behavioral change have to be pursued as any intervention, without tackling the source reduction concern, is bound to encounter sustainability issues. Waste generation reduction and material recovery measures have to be embedded among the major sources of wastes including residences, markets and institutional nodes. As biodegradables comprise more than half of classified wastes, material diversion opportunities abound through composting and organic matter processing hubs.

The visibility of Barangay officials as frontliners in waste management has to be improved to enhance government presence. The lack of institutional presence from oversight bodies and poor thematic focus on waste reduction aspect lead to the generation of unmanageable material volume. The role of barangays as the smallest unit of government has to be revisited and enhanced as too much dependence on municipal prodding and resource downloads compromise program grounding.

The DENR and LGUs must also cooperate in the identification of potential sites for the establishment of waste management facilities, including subscription and compliance to land use and environmental clearances. A very partial focus on waste collection and processing also only leads to increases in servicing fees of recipient landfills and shortens operational life of sanitary facilities due to material saturation. With only one landfill servicing bulk of the wastes in Central Luzon and a cluster SLF for Metro Manila, this should stir immediate discussions on viable waste management alternatives at the subnational level.

Formalization has to be pursued among the informal workers and settlers whose subsistence depend on local waste management operations. The legal transition to proper material recovery and engineered landfills must not result to the full displacement of dumpsite dwellers and scavengers. Alternative housing and livelihood opportunities must be explored; and the bounty of youth and manpower must be capitalized on the make waste management operations sustainable. During the transition, these scavengers and waste pickers could be utilized as partners in segregation and recycling activities. The institutionalization process of the informal

economy could be replicated from the experience and local successes of Quezon City and Rizal province.

Continued capacity building and information, education and communication campaign need to be sustained for all stakeholders, especially in communities grappling with the concept and application of waste reduction, segregation, reuse and recycling. Local governments must be enabled with the means to implement and sustain locally appropriate SWM programs in terms of institutional structure, human resource complement, and funding. SWM programs have to transcend political tenures and relate to stakeholders of different genre.

Current SWM policy may be augmented given the added layer of complexity brought about by the COVID-19 pandemic. The NSWMC and the DENR must be resolute and clear about functional policy adjustments relating to practical health and ecological integrity issues. A broader risk landscape necessitates changes in terms of greater worker protection (training and equipment); more strict waste handling and safety protocols; and proper treatment and disposal of bio-medical wastes. At the very least, this should entail clarification on the arsenal of tools available to local managers. An example is the availment of acceptable incineration technology, whose use is sensible when dealing with biomedical and other hazardous wastes.

Finally, enabling mechanisms in grounding SWM policy must not just reflect RA 9003's over reliance on LGU policy implementation. The whole of government necessitates subnational capacity build-up; NGA-LGU-private sector- CSO complementation; LGU-community interface; and LGU-LGU clustering and cooperation. The importance of these elements come to fore when dissecting the reasons why the country has achieved relatively so little in two decades of policy grounding. It is also apparent that the national government needs to transfer more resources and augment funds down the line to fast track SWM facility investment and compliance.

8. Conclusion

Republic Act 9003 or the Ecological Solid Waste Management Act in 2001 was meant to ensure the protection of public health and environment; encourage resource conservation and recovery; promote national research and development programs; commit LGUs and incentivize/institutionalize public and private sector participation; encourage cooperation and self-regulation through market-based instruments; and promote environmental awareness and action among the citizenry.

Increased dynamism in pre-pandemic local economies translated to increased consumption and waste generation among a majority of the country's cities and municipalities. Even in a more tempered economic environment during (and post) the COVID 19 pandemic, waste generation and management issues remain critical with projections pointing to more dire consequences. But policy and institutional augmentations both at the national and subnational levels remain wanting.

If properly implemented, the provisions of Republic Act 9003 would have conveniently and strategically allowed for the imposition of systematic and structured remedies. But positive outcomes rarely come that easy given bureaucratic realities. The overly simplistic transfer of responsibility to local government units, even just to complement the local government code, have resulted to two decades of mediocre policy grounding. Although commendable islands of

successes were seen in the case study sites, no ideal holistic solid waste management set-ups were manifested: illegal dumpsites still exist, waste generation is still unabated, material recovery is suboptimal, technology and facility investment is subpar, and public and private participation are wanting.

Still, indications of policy compliance were visible. Solid waste management units have been institutionalized both at the national and subnational levels, with the NSWMC as consolidator; there were forced closure of open/illegal dumpsites and establishment of sanitary landfills; waste diversion targets and material recovery facilities were instituted; and the public has been initiated on waste management tenets. The implementation of the law in local areas was also guided by 10-year solid waste management plans and directed by focal persons, task forces, and environmental offices. However, the process was riddled with bureaucratic delays in approval of plan, lack of retention of technical officers, and budget constraints. Private contractors oftentimes bridged the gap in such lapses, allowing for improvement in compliance rate of MRFs, livelihood generation in facilities, and in information campaigns.

Documented best practices across study sites include the legal waste facility transition of the Payatas dumpsite and the organization of informal its economy; the clustering waste management service of Teresa, Rizal and its province-wide incentive mechanism, and partnerships with construction companies; and the market linkages for revenue generation; and the strong LGU-CSO partnership in San Fernando, Pampanga. Such are practical success templates and arrangements that could be replicated across LGUs.

However, a holistic approach to solid waste management in country necessitates a non-fragmented approach sub-nationally. The transboundary concern of waste-related problems, and the limitations of many local government units, require more cooperation, complementation, and resource-sharing among them. The national government may also have to play a more active role in the design and financing of mandated sanitary landfills; and clustering approaches among adjacent LGUs have to be promoted as not all localities can host the establishment of engineered facilities.

Standard designs for state-of-the-art waste management facilities with apt by-product processing and marketing components need to be spearheaded by the NSWMC and the country's science and technology department. Financing and construction of mandated waste management facilities may be in the mold of the national government's Build, Build, Build program. This is necessary as much of the delays in grounding policy point to investment programming issues particularly among poorer municipalities.

Vertical institutional alignments also have to be revisited and strengthened as national and subnational connections appear weak. The national government must go beyond just oversight functions in policy grounding, provinces must truly integrate the plans and programs of their covered cities and municipalities; barangays have to be capacitated and empowered so that they can contribute and not be just dependent on municipal prodding; and the strength of CSOs and other community groups have to be harnessed.

The overlapping concern on the high waste generation and the limited disposal facilities further highlight the simple principles of reduce, reuse and recycle. Engineered sanitary landfills, regardless how state of the art they are, have limited lifespan and service capacities until they are saturated. Waste-to-energy projects and incineration facility proposals have to be assured in terms of DENR's emission standards. If such run contrary to the provisions of RA9003 and the clean air act, then a formal congressional amendment may be needed.

Largely hinged on ecological integrity and public health, solid waste management presents very practical concerns that both national and local governments cannot afford to ignore. The amount and level of effort and investment on SWM must therefore be reflective of the breath of its impact on the economy, and people's lives and daily functioning. The approach in this thematic area should be dynamic and problem-solving, capitalizing on avenues for resource augmentation, coordination and complementation, incentive and technology provision, and informal economy and community welfare address.

9. References

Abd Kadir, S.A.S., Yin, C-Y., Sulaiman, M.R., Chen, X., and El-Harbawi, M. 2013. Incineration of municipal solid waste in Malaysia: Salient issues, policies, and waste-to-energy initiatives. Renewable and sustainable energy reviews, 24:181-186.

Asian Development Bank (ADB). 2014. Republic of the Philippines: Solid Waste Management Sector Project Technical Assistance Consultant's Report. Mandaluyong City: ADB.

Beede, D. N. & Bloom, D. E. 1995. The economics of municipal solid waste. The World Bank Research Observer 10(2):113-150.

Biong, I. 2020, April 14. EcoWaste to DENR: Disallow incineration of COVID-19 'wastes'. *Cebu Daily News.* https://cebudailynews.inquirer.net/302471/ecowaste-to-denr-disallow-incineration-of-covid-19-wastes (accessed on August 29, 2020).

Cabico, G. K. 2020, August 27. In the Philippines, medical waste piles up as COVID-19 cases rise. *Philstar.com*. https://earthjournalism.net/stories/in-the-philippines-medical-waste-piles-up-as-covid-19-cases-rise (accessed on December 1, 2020)

Christie, P., Lowry, K., White, A. T., Oracion, E. G., Sievanen, L., Pomeroy, R. S., Pollnac, R.B., Patlis, J. M., & Eisma, R. L. V. 2005. Key findings from a multidisciplinary examination of integrated coastal management process sustainability. Ocean and Coastal Management 48(3-6):468-483.

Colina IV, Antonio L. 2018, October 3. Davao to proceed with Japanese-funded waste incineration project. *MindaNews.* https://www.mindanews.com/top-stories/2018/10/davao-to-proceed-with-japanese-funded-waste-incineration-project/ (accessed on December 1, 2020).

Environmental Management Bureau – Solid Waste Management Division (EMB-SWMD). 2016. Annual Report 2016. Quezon City, Philippines: DENR.

Escovilla, J. 2020, July 1. Special report: Policy review of waste management needed as Davao City grapples with household PPE waste. *MindaNews.* https://www.mindanews.com/special-reports/2020/07/special-report-policy-review-of-waste-management-needed-as-davao-city-grapples-with-household-ppe-waste/ (accessed on December 1, 2020).

EPA. 2010. Municipal solid waste in the United States (2009): Facts and figures. United States Environmental Protection Agency. Washington, DC. http://www.epa.gov/epawaste/nonhaz/municipal/pubs/msw2009rpt.pdf (accessed on January 16, 2019).

Gamaralalage, P. J. D., Gilby, S., Lee, K. 2015. The Republic Act (RA) 9003 in the Philippines: Factors for Successful Policy Implementation. *The 26th Annual Conference of JSMCWM*, 560-61.

Gonzales, A. L. E. 2020, October 6. LGUs must prepare for new responsibilities – Dominguez. *The Manila Times.* https://www.manilatimes.net/2020/10/06/business/business-

top/lgus-must-prepare-for-new-responsibilities-%E2%80%95-dominguez/776898/ (Accessed on December 3, 2020)

Hogg, D. & Ballinger, A. 2015. The potential contribution of waste management to a low carbon economy. Bristol, UK: Eunomia.

Hoornweg, D. & Bhada-Tate, P. 2012. What a waste: A global review of solid waste management. World Bank, Washington. http://www.openknowledge.worldbank.org/handle/10986/17388License:CCBY3.0IGO accessed on January 16, 2019

Kaza, S., Yao, L., Bhada-Tata, P. & Van Woerden, F. 2018. What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050. *Urban Development Series.* Washington, DC: World Bank.

Kuhling, J-G., & Pieper, U. 2012. Management of healthcare waste: Developments in Southeast Asia in the twenty-first century. Waste Management & Research 30(9): 100-104.

Larsen, R. K., Acebes, J. M., Belen, A. 2011. Examining the assumptions of integrated coastal management: Stakeholder agendas and elite cooption in Babuyan Islands, Philippines. Ocean and Coastal Management 54(1):10-18.

Lowry, K., White, A., Courtney, C. 2005. National and local agency roles in integrated coastal management in the Philippines. Ocean and Coastal Management 48(3):314-335.

Markgraf, C. & Kaza, S. 2016. Financing Landfill Gas Projects in Developing Countries. Urban Development Series Knowledge Papers, 2016 No. 23. World Bank.

Material Economics. 2018. The circular economy: A powerful force for climate mitigation. Stockholm, Sweden: Material Economics.

National Environment Agency (NEA). 2019. Solid waste management infrastructure. https://www.nea.gov.sg/our-services/waste-management/3r-programmes-and-resources/waste-management-infrastructure/solid-waste-management-infrastructure (accessed on December 2, 2020).

National Solid Waste Management Commission (NSWMC) & Japan International Cooperation Agency (ADB). 2010. Guidebook for Formulation of Solid Waste Management Plan, first edition.

National Solid Waste Management Commission (NSWMC). 2015. National Solid Waste Management Status Report (2008–2014). https://nswmc.emb.gov.ph/wp-content/uploads/2016/06/Solid-Wastefinaldraft-12.29.15.pdf (Accessed on August 5, 2019).

NSWMC. 2018. National Solid Waste Management Status Report (2008-2018). https://emb.gov.ph/wp-content/uploads/2019/08/National-Solid-Waste-Management-Status-Report-2008-2018.pdf (Accessed on December 27, 2020).

No Burn Pilipinas. n.d. Uphold the Philippine Ban on Waste Incineration. Bataris.org. https://www.bataris.org.ph/petitions/uphold-the-philippine-ban-on-waste-incineration (accessed on August 30, 2020).

Pappu, A., Saxena, M., & Asolekar, S.R. 2011. Waste to wealth-cross sector waste recycling opportunity and challenges. Journal of Civil and Environmental Engineering 2(3):14-23.

PhilAtlas. n.d. Pampanga. https://www.philatlas.com/luzon/r03/pampanga.html (accessed on August 2, 2020).

Preston, F. & Lehne, J. 2017. Briefing: A wider circle? The circular economy in developing countries. London: Chatham House, the Royal Institute of International Affairs.

Provincial Government of Pampanga. 2013, November 29. General Information. https://www.pampanga.gov.ph/index.php/general-information/gen-info.html (accessed on August 2, 2020).

Roberts-Davis, T. L. & Guerrero, L. B. 2018. ADB and Waste incineration: Bankrolling pollution, blocking solutions. Quezon City, Philippines: Global Alliance for Incinerator Alternatives (GAIA).

Shekdar, A.V. 2009. Sustainable solid waste management: An integrated approach for Asian countries. Waste Management 29(4):1438-1448.

Teresa Municipal Environment and Natural Resources Office (MENRO). 2014. Municipality of Teresa Rizal Integrated Solid Waste Management Plan.

Teresa MENRO. 2020, March 11. Key Informant Interview.

Teves, C. 2019, January 22. DENR pursues waste-to-energy option. *PNA Philippine News Agency*. https://www.pna.gov.ph/articles/1059628 (accessed on August 29, 2020).

Themelis, J., Diaz Barriga, M., Estevez, P., & Gaviota Velasco, M. 2013. Guidebook for the application of waste to energy technologies in Latin America and the Carribean. New York: Earth Engineering Center, Columbia University.

Wynne, A. L., Nieves, P. M., Vulava, V. M., Qirko, H. N., & Callahan, T. J. 2018. A community-based approach to solid waste management for riverine and coastal resource sustainability in the Philippines. Ocean and Coastal Management 151:36-44.

Yadav, P. & Samadder, S.R. 2017. Assessment of applicability index for better management of municipal solid waste: A case study of Dhanbad, India. Environmental Technology 37:1-36.

Ynares Ecosystem (YES) Team. 2020, March 11. Focus group discussion.