

December 21st, 2023

Director Jacqueline A. Caancan

Department of Environment and Natural Resources

Region IV-A CALABARZON

DENR Regional Office IV-A Building

DENR Compound, Visayas Avenue, Diliman

1100 Quezon City

Re: An Analysis of Metro Manila's Solid Waste Management Crisis

Dear Director Caancan,

On behalf of the University of British Columbia, we would like to humbly bring to light our analysis of the current state of the Philippines' solid waste management infrastructure, using the 17 Local Government Units of Metro Manila as a representative sample.

First and foremost, despite the inherent gravity and complexity of the sanitation sector, we strongly believe that recent developments within the Filipino sanitation sector present an optimistic view of the country's near future; the transformation of the once infamous Payatas landfill into a cyclist-friendly park serves as one of many symbolic evolutions for what is to come.

However, in order to prevent a relapse of crises experienced in recent years, our team has conducted a thorough assessment of the various institutional incentives, infrastructural inefficiencies, and demographic patterns that have impeded the DENR's determined efforts to improve the nation's solid waste management systems. Through our research, we recognized the non-existence of a single, comprehensive report detailing the diverse array of confluent factors affecting the sanitation sector; our work hopes to fill this gap and, in effect, yield a source of easily digestible information for future development projects.

This assessment was conducted because we understand the significance of your department's focus; the sanitation sector is arguably the most important sector of any nation. We extend our sincere gratitude not only for your time and availability, but for your continued dedication toward bettering the lives of millions of individuals.

Best Regards,

UBC's Food and Resource Economics Team



Waste Management In Metro Manila

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Executive Summary

Metro Manila produces less waste per capita than Los Angeles, London, and Toronto, yet undeniably struggles more with solid waste management; the purpose of this paper is to determine exactly where things going wrong. Our analysis begins by summarizing the salient qualities of Metro Manila that render the region contextually relevant to the broader solid waste crisis of the Philippines; we provide an overview of the region's current state and regulatory framework, followed by a complimentary assortment of key figures and statistics. This section is concluded with a thorough examination of the active roles played by the public, as well as the identification of four significant stakeholders and their current 'status' under the status quo:

- The informal sector (**Losers**)
- Local government units (**Winners**)
- International Donors and Corporations (**Winners**)
- The private waste sector (**Winners** and **Losers**)

Next, the paper compiles the past 60 years of relevant, historical development within a comprehensive timeline. Notable policies are then identified and dissected, enabling the extraction of the structural causes of the various failures within each policy. Highlighted pieces of legislation in this section include:

- The Extended Producer Responsibility Act
- The Metropolitan Manila Development Authority Act
- The Ecological Solid Waste Management Act.

The efficacy of these policies are further contextualized with additional contributing factors and confounding externalities. We follow this with a refined list of policy alternatives and amendments, geared toward enabling specific, pragmatic mechanisms of change. We recommend amending:

- The Magna Carta of the Poor
- The Public-Private Partnership Code

Finally, our paper outlines two extensive recommendations:

- Invest in specialized infrastructure
- Legitimize the informal sector

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List Of Acronyms

DENR	Department of Environment and Natural Resources
EPR	Extended Producer Responsibility
ERF	Energy Recovery Facility
ERF ²	Emission Reduction Facilities
GDP	Gross Domestic Product
LGU	Local Government Unit
MMDA	Metropolitan Manila Development Authority
MRF	Materiel Recovery Facility
MSW	Municipal Solid Waste
NCR	National Capital Region
NGO	Non government Organization
NSWMC	National Solid Waste Management Commission
PSWMSP	Philippine Solid Waste Management Sector Project
PY	Project Year
RA	Republic Act
RDC	Regional Development Council
SLF	Sanitary Landfill
SWM	Solid Waste Management
WTE	Waste-to-Energy

Glossary Of Terms

This comprehensive lists includes: definitions of technical terms, descriptions of key organizations, and significant factors of key geographical areas.

Barangays: The smallest administrative division in the Philippines, equivalent to a village, district, or ward. There are 42,029 barangays in the country, and 897 in Metro Manila.

Department of Environment and Natural Resources (DENR): National government department responsible for managing and conserving the country's natural resources, including waste management. The DENR had a budget of P23.29 billion (US 420 million) in 2023.

Eco-Aides: Workers employed within the informal sector, involved in collecting recyclable materials from households and selling them to junk shops. These workers are largely hired by the Linis Ganda Foundation.

Illegal/Open Dumpsite: Unregulated and unauthorized sites where waste is disposed of, often leading to environmental and health hazards. The last open dumpsites in the Philippines were closed in 2021.

Junk Shops: Businesses involved in the collection, sorting, and selling of recyclable materials gathered by waste pickers and eco-aides.

Leachate: Toxic secretions from landfill sites containing high levels of lead, arsenic, fecal coliform, and other dangerous contaminants.

Linis Ganda Foundation: The organization responsible for Metro Manila's network of eco-aides and junk shops.

Local Government Units (LGUs): The municipal administrative division in the Philippines, one step larger than barangays. There are 1,634 LGUs in the Philippines, and 17 in Metro Manila.

Manila Bay: A natural harbor located in Luzon, west of Manila. The bay aggregates most of the waste disposed of into waterways; its rehabilitation is a high priority, considering the bay's relevance to shipping, fishing, aquaculture and tourism in the Philippines.

Material Recovery Facilities (MRFs): Facilities where recyclable materials are separated and prepared for reprocessing.

Glossary Of Terms

Metropolitan Manila Development Authority (MMDA): The government agency responsible for urban planning and development in the Metro Manila area. The MMDA had a budget of P2.6 billion (US 47 million) in 2023, which was largely dedicated toward solid waste management.

MIMAROPA: The largest region in the Philippines by geography, containing 5 of the Philippines' 82 provinces including Palawan, the country's largest province.

National Capital Region (NCR): The official designation for Metro Manila, emphasizing its status as the nation's capital and center of government administration.

Pasig River: A crucially important waterway that flows through Manila, connecting Laguna de Bay to Manila Bay.

Republic Act: Legislation created by the Congress of the Philippines, then signed by the President.

Sanitary Landfill (SLF): A landfill designed for environmentally safe disposal of solid waste, engineered to prevent leachate seepage as well as reduce air pollution. This is accomplished by layering solid waste with fresh soil.

Solid Waste Management (SWM): The process of collecting, transporting, processing, recycling, and disposing of solid waste materials.

Tipping Fees: Fees paid by LGUs to SLFs when disposing waste at their facility. In Metro Manila, this fee is typically P600 per ton.

Waste Paper Dealers: Companies or individuals who purchase sorted recyclable paper from junk shops for reprocessing.

Waste Pickers/Scavengers: Individuals who earn a living by collecting and selling usable or recyclable materials from dumpsites.

Waste to Energy (WTE) Facility: A facility that uses combustible waste as a fuel source for generating energy.

4.0 Guiding Questions

What set of circumstances facilitated the rapid industrialization and urbanization of Metro Manila? Furthermore, what were the particular aspects of these circumstances that failed to concurrently support the development of an adequate solid waste management system?

Given that efficient waste collection and disposal practices are generally more cost-effective for governments, what barriers impede LGUs from implementing crucial infrastructural developments that have already been demonstrated to be effective? Are these barriers primarily related to insufficient financial capacity, stagnant political behavior, or a combination of several confluent factors?

How significant is Metro Manila's 'informal sector'? What roles are played by stakeholders beyond LGUs, such as community initiatives, NGOs, international programs, and local individuals who have been born and raised in landfill dwellings?

Just over 20 years have passed since the Payatas collapse in Quezon City; considering that solid waste production increases constantly, what protocols and capacities have been implemented during these years to avoid sequential catastrophe? If Metro Manila's SLFs were to reach capacity right now, would the aftermath be more, less, or comparable to the consequences of the Payatas collapse?

How dependent is Metro Manila's sanitation sector on international donors and aid programs? What domestic deficiencies, if any, have been enabled by continued external reliance?

In comparison to adjacent ASEAN regions, what qualities are unique to Metro Manila? In other words, how can Metro Manila strategically position its development to take advantage of its natural resources and conditions?

Historically, have LGUs been primarily motivated by positive or negative reinforcement? Has greater institutional change been enacted through the promise of incentives, or the threats associated with being held accountable?

5.0 Background of Waste Management in Manila

5.1 Present State Overview

Regional Significance

Metro Manila is geographically small, only spanning 636 km²; in comparison, the MIMAROPA region holds domain to 29,621 km² of land and sea. However, due to its central location and urban prospects, Metro Manila was declared the National Capital Region (NCR) of the Philippines in 1975, and has since remained the political, economic, social, and cultural region of the nation. The NCR not only boasts a population of 13.5 million, 11.85% of the Philippines' total, but accounts for 36% of the country's GDP. Unfortunately, Metro Manila is also a leader in waste production; of the country's 35,580 tons of solid waste produced every day, Metro Manila accounts for nearly 27% of it.

5.1.1 Regulatory Framework

Government Structure

There are four administrative divisions in the Philippines, which can be organized from largest to smallest as following:

- The government is first divided into 17 regions, Metro Manila being one of them.
- Regions are then divided into provinces; there are 82 provinces in the Philippines.
- Provinces are typically then divided into cities and municipalities, both of which can be classified as Local Government Units (LGUs). Metro Manila's administrative properties are unique in the sense that it is comprised of 17 LGUs, but effectively skips the provincial division. There are 1,634 LGUs in the Philippines.
- Finally, LGUs are divided into barangays, the smallest administrative unit. There are 42,029 barangays in the country, and 897 in Metro Manila.

LGUs are responsible for the local enforcement of Republic Acts within their respective barangays. Most policy coordination is done at the provincial level, within Regional Development Councils (RDC); Metro Manila doesn't have an RDC, but instead abides by the Metropolitan Manila Development Authority (MMDA), which holds its own set of councils. Correspondingly, Metro Manila's unique administrative autonomy greatly impacts the due processes involved in enforcing policy.

5.0 Background of Waste Management in Manila

5.1.2 Key Figures and Statistics

Infrastructure Capacity

There are now 318 operational sanitary landfills (SLFs) serving 29.25% of all LGUs and 11,637 material recovery facilities (MRFs) serving 39.05% of all barangays. There is only one waste-to-energy (WTE) facility in the Philippines, located in Rizal (province). All illegal open dumpsites were reportedly closed in 2021, although an indefinite number of LGUs still lack capacity or access to SLFs and MRFs, indicating that some number of open dumpsites must exist off the record.

Collection and Disposal

In The World Bank 2020 report it was revealed that Metro Manila generated about 9,500 tons of waste per day in 2020, and is projected to rise to 10,400 tons per day by 2025. The study found that only about 60% of this waste is collected daily, translating to roughly 5,742 tons per day. In comparison, Jakarta collects 74% of its waste, and Bangkok 81% (Reyes, 2023).

At a standard conversion rate of 50% from raw material to compost, a potential daily production of 1,000 tons of compost could be obtained. But the few composting facilities in Metro Manila, at full capacity, can only process 10 tons of compost per day.

RA Compliance and Enforcement

400 LGUs have yet to create a solid waste management (SWM) plan in compliance with RA 9003 and 3,400 firms have yet to comply with the EPR Act (Reyes, 2023).

Public Perception

An estimated 150,000 residents of Metro Manila know the sight and smell of garbage as an integral part of their daily lives.

A total of 78% of surveyed households had no idea where their collected garbage was taken for final disposal.

5.0 Background of Waste Management in Manila

5.1.3 Key Stakeholders

Informal Sector

The informal sector of waste management comprises various entities such as individuals, families, collectives, or small businesses. These parties are actively involved in recovering materials from waste for the purpose of generating income either part time or full time. They are often composed of mobile waste purchasers, individuals who sort through collection trucks, members of garbage collection teams, reclaimers of waste materials, and small-scale, often unlicensed junk shops (J.P. Paje, 2021). This sector includes individuals or groups that operate outside of formal organizational structures, like NGOs or LGUs. They often work independently or in loosely organized groups without formal recognition or support from governmental or private entities. Their work is usually characterized by a lack of formal contracts, labor protections, and health and safety regulations (DownToEarth, 2021).

The recycling processes carried out by this informal waste sector contribute to resource conservation and enable productive material utilization. These activities tend to be more energy-efficient and economical compared to similar activities in the formal sector. However, a notable drawback is that individuals in this sector often operate in environments that are unsafe and pose health hazards (J.P. Paje, 2021).

Despite its contribution to the implementation of the 3Rs, the informal sector was not recognized in the NSWM Framework that was prepared in 2004. Following the shutdown of open dumps and regulated disposal sites, new challenges arose concerning the loss of income sources for certain waste pickers and mobile buyers. This added to the existing difficulties encountered by various cities and municipalities. In response to these challenges, the National Solid Waste Management Commission formulated and implemented the National Solid Waste Management Framework specifically for the Informal Waste Sector. However, the only support received was the implementation of a junkshop in the barangay SWM committee (J.P. Paje, 2021).

5.0 Background of Waste Management in Manila

5.1.3 Key Stakeholders

Local Government Units

Metropolitan Manila comprises 17 Local Government Units (LGUs), with 14 designated as cities and 3 as municipalities. It serves as the Philippines' Centre for trade, commerce, and industry (YU, 2006). The Local government code of 1991 provided a transition of numerous responsibilities from the national government to local governments, particularly in solid waste collection and disposal. Under this system, cities and municipalities manage solid waste disposal, while barangays handle its collection. It also tasks LGUs to collect fees and taxes on waste management also referred to as “user fees”. These fees are typically collected by LGUs from businesses and residents for SWM fees (YU, 2006).

NGOs and Community-Based Solid Waste Management

Prior to the passage of RA 9003, Metro Manila had incorporated Community-based Solid Waste Management Projects (CBSWM). Just within the framework of partnerships with entities like Coca-Cola Foundation Philippines, several CBOs are engaged in initiatives like the Blastik Project, the Caritas Manila's solid waste management program, and other recycling and waste reduction projects (Rappler, 2020). Additionally, Caritas Manila itself has organized 16 groups of Eco Waste collectors, focusing on waste collection and recycling as part of their livelihood project (UN-Habitat Philippines). These organizations are substantial ranging from several dozen to potentially hundreds. They are composed of smaller, local community-driven initiatives with no support from the government as well as larger-scale projects that receive support from international bodies and governmental partnerships (YU, 2006).

The Private Sector

The private sector in Metro Manila is actively involved in SWM, collaborating with local governments to address waste management challenges. For instance, Parañaque City has partnered with the Philippine Alliance for Recycling and Materials Sustainability (PARMS) through a Memorandum of Agreement to establish a plastic waste recycling facility in the city's Materials Recovery Facility (MRF). This partnership aims to address the environmental challenges of plastic waste, support the enactment of the city's 10-year Solid Waste Management Plan, and increase compliance with the Ecological Solid Waste Management Act of the Philippines (RA 2003) (ICLEI, 2021). This is a part of the larger effort to manage waste production across the 17 local governments in Metro Manila, where Parañaque is noted for generating the 4th-most waste among its peers (ICLEI, 2021)

5.0 Background of Waste Management in Manila

5.1.4 Public Perception and Participation

Health and Sanitation

Public perception is largely influenced by the significant health and environmental issues arising from ineffective waste management practices. A major concern is the link between poor sanitation and prevalent health problems, including bronchitis, diarrhea, and tuberculosis. These health issues are often attributed to inadequate waste disposal, where a substantial portion of the daily 7000 metric tons of solid waste remains uncollected, contributing to garbage accumulation in streets and waterways, pollution and health hazards (C. Bernardo, 2008).

Residents in the area rely on waste collection services provided by the government, which are carried out through privately hired garbage collectors. Without designated waste collection zones, people often leave their garbage at random locations, typically corners, which are not official pick-up points. The absence of garbage bins on the streets encourages this practice and furthermore creates a breeding ground for disease carriers, such as flies, mosquitoes, cockroaches, and rats. Furthermore, this garbage is often scattered by both scavengers and stray animals. Due to cultural practice, men are typically at work while the responsibility for managing household waste generally falls to mothers and domestic helpers. However, residents report that they do not separate biodegradable from non-biodegradable waste because garbage collectors mix all types of waste in the same truck. Additional reasons for not segregating waste include limited time, insufficient space, cost, and perceived lack of importance (C. Bernardo, 2008).

“Eighty-nine percent of the respondents who practiced waste segregation indicated that they sell their PET bottles and glass bottles to collectors, who further sell these items to junk shop owners. Some give their PET bottles to scavengers. Two percent turn their recyclable materials into useful products, such as handicrafts.” (C. Bernardo, 2008)

5.0 Background of Waste Management in Manila

5.1.4 Public Perception and Participation

Insights from Household Surveys

- When asked to identify key elements for an effective waste management program households expressed the necessity for political commitment, disciplined behavior among residents, the importance of educational campaigns about proper waste disposal, and the enforcement of the Solid Waste Management Act of 2000 (RA 9003) (C. Bernardo, 2008).
- A majority of the households (69%) believe that waste collection and disposal is a governmental duty, while others view it as a shared responsibility between the government and community.
- They expressed a willingness to pay for waste collection services, provided they are conducted regularly.
- They also proposed the establishment of a designated area for waste storage, awaiting collection by trucks. This area should be equipped with large, covered bins to prevent bad smells, the attraction of insects, and the spread of disease, as well as to stop waste from being scattered.
- Additionally, some residents speculated that open dump sites “may be linked to dengue fever cases among their family members” (C. Bernardo, 2008).

6.0 Historical Context and Policy Failures

6.1 Historical Development

Phase I: Setting the Stage (1960-86)

1960-73: Metro Manila (MM), still young and recovering from the Second World War, was growing rapidly. In 1903, Manila's population stood at 220,000; 60 years later, the region held over 2.2 million residents. MM's population expansion was primarily due to mass rural immigration from nearby Filipino regions that had not yet urbanized (Medina, 2007). An optimist would point out that this trend greatly increased MM's labor force; however, this new labor force was not only uneducated and unskilled, but oversized for the existing infrastructure. Two waste-related phenomena came from MM's demographic surge: first, the sanitary infrastructure had to hastily adapt to the millions of additional consumers in the region, resulting in the creation of massive, unregulated landfills, including the infamous Smokey Mountain and Payatas dumpsites; then, in tragic irony, these new dumpsites became the home for many of MM's unskilled immigrants. These dwellers would come to be known as waste pickers, an impoverished demographic of families whose sole income derived from scrounging usable or recyclable materials from the dumpsites.

1975-78: Metro Manila has now been declared the National Capital Region (NCR) of the Philippines. This political officiation cemented the responsibility of solid waste management into government hands, specifically the 17 Local Government Units (LGUs) within MM. During these years, many Presidential Decrees relating to environmental regulations were enacted; these laws included provisions for garbage disposal, waste collection, pollution control, and more. Unfortunately, due to corrupted political will, a lack of existing infrastructure, and the practical difficulty of monitoring dozens of separate legal codes, these decrees were never seriously enforced.

1981-86: Under the controversial leadership of President Ferdinand Marcos, the Philippines' external debt ballooned to over \$28.3 billion US (add in-text citation). This debt not only overshadowed the financial, social, and political importance of MM's growing solid waste crisis, but also set the precedent for the country's long lasting dependence on foreign aid. By this point, waste picking had become a way of life for thousands of families; studies revealed that 40% of these destitute residents had some form of skin disease and 70% had upper respiratory ailments (ADB, 2014).

Phase II: The Awakening (1987-99)

1987-92: The Department of Environment and Natural Resources (DENR) is founded, which continues to serve as the primary institution concerning the preservation and development of the country's natural resources; as expected, many of their key programs concern solid waste management.

Metro Manila's rural migration has not slowed down; the region's population reached a staggering 7.5 million residents in 1988. An estimated 3,000 families live off of the Smokey Mountain dumpsite, which has aggregated over 2 million metric tons of solid waste since its inception (Medina, 2007).

1992-95: Facing tremendous international pressure, the Smokey Mountain dumpsite is closed; the waste pickers migrate to the Payatas landfill, where 1,000 individuals are hospitalized by a typhoid fever outbreak caused by water pollution (Medina, 2007). In response, the Vincentian Missionaries Social Development Foundation (VMSDF) organized a savings and credit program for the scavengers of the Payatas dumpsite; by 2003, this program managed over \$300,000 US in savings across its community of scavengers (Gonzales, 2003).

Foreign aid has started to accelerate:

- The Department of Health (DOH) acquired 26 medical waste incinerators and 36 microwave-disinfection machines from the Austrian government (AusAID),
- Environmental rehabilitation projects near the Pasig River are funded by the Danish International Development agency (DANIDA) and Asian Development Bank (ADB),
- and an interesting study demonstrated that higher income residents of MM generated substantially more waste than their lower income counterparts (Medina, 2007).

1996-99: The installation of the Linis Ganda Foundation introduces a new economic ecosystem to MM's sanitary sector. The foundation employs 'eco-aides', who drive push carts around the region buying various recyclable papers and plastics from households; then, eco-aides sell these materials to junk shops at a higher price; finally, the junk shops sort and sell high volumes of these materials to waste paper dealers and other industry players. In 1997, eco-aides collected 69,400 tons of materials, and by 2003, the foundation represented 572 junk shops and 1,300 eco-aides across MM's 17 LGUs.

Additional aid programs are initiated, including a \$55 million US enhancement project loaned by the World Bank (WB), and hazardous waste studies conducted by the European Union (EU) and the Japanese International Cooperation Agency (JICA). This support was partially inspired by the newly enacted Clean Air Act, which unfortunately banned the use of the 26 incinerators donated just two years ago (Gonzales, 2003).

Public opposition induced the closure of two major dumpsites in Carmona and San Mateo (AEA, 2003). Despite the good intentions of the people, the government, and foreign supporters, MM was on the brink of disaster; the region was generating 5,350 tons of solid waste per day and recycling only 6% of it (Gonzales, 2003). After the dumpsites closed, MM's existing landfills were reaching capacity.

Phase III: Crisis and Response (2000-10)

2000-01: After several days of heavy rain, the Payatas landfill collapsed, crushing 200 scavengers alongside the community dwellings that had formed around the dumpsite (ADB, 2004). Payatas was temporarily closed; with solid waste now piling in the streets, the public became acutely aware of the crisis at hand. Payatas was reopened months after the collapse, and as a result of MM's inability to develop effective sanitary infrastructure, all of the aforementioned donor initiatives pulled out their funding. The Ecological Solid Waste Management Act (RA 9003) is enacted in response to the Payatas collapse; in contrast to the Presidential Decrees enacted in the 1970s, RA 9003 was a single, comprehensive, forward-thinking law designed to create robust institutions and incentives at all levels of solid waste management (SWM) (Gonzales, 2003). In 2001, the country generated 9 million tons of solid waste; at the same time, geologists from the University of the Philippines discovered toxic secretions from Payatas collapse known as leachate (Sy, 2000).

2002-04: With Payatas reopened, RA 9003 ambitiously enacted, and a temporary, private transfer and disposal system installed by the United States Agency for International Development (USAID), Metro Manila had persevered through the hardships of 2000 and 2001. Not only had donor activity recommenced, but a \$215 million PHP engineered sanitary landfill (SLF) was built in Capas, which serviced 100 LGUs by 2019 (Navarro, 2019).

Despite the recent Payatas collapse, 78% of surveyed households in MM have no idea where their waste is disposed; the region now generates 6,700 tons of solid waste per day, 13% of which is recycled (ADB, 2004). Attention has started to be drawn to the financial inefficiency of the sanitary sector; the cost to collect and dispose waste in MM averages 1,450 pesos per ton, yet less than 25 pesos are collected per capita (ADB, 2004). However, external systems are working well; in 2004, the Linis Ganda Eco Aide Program workers collectively earned \$10 million US in wages and collected 210,000 tons of materials (4.5% of the total waste), effectively saving the country's LGUs \$660 Million US in total (Medina, 2007).

2005-08: Metro Manila continued to develop the physical and financial infrastructure of its sanitary sector. In 2005, 11 of MM's 17 LGUs were privately contracting their garbage collection, while the other 6 were collecting it themselves as part of their local government fund. The CBESWMP initiative successfully built sanitary capacity and infrastructure in 10 target barangays, and the first Waste to Energy (WTE) facility was built in Rizal. Between 1993 and 2008, the country had received \$860.18 Million US in assistance from the ADB alone; the Filipino waste crisis had unquestionably been realized as globally important (ADB, 2014).

Phase IV: Slow and Steady (2011-18)

2011-18: While still far from perfect, progress had been made in Metro Manila. At the turn of the millennium, the Payatas dumpsite was collapsing and notions of 'institutional sanitation' were barely in nascent stages of discussion; in 2011, MM boasted 933 Material Recovery Facilities (MRFs) across its 897 barangays, zero illegal dump sites, and 48 certified SLFs under construction (IDE, 2011). Rizal's WTE facility was now processing 3,000 tons of waste per day (ADB, 2014). However, further progress was delayed by poor implementation of RA 9003; of MM's 17 LGUs, only one had its 10-year SWM plan approved, and another seven LGUs had yet to submit it (ADB, 2014). The importance of these plans should not be underestimated; although MM's infrastructure had been improving year after year, so had its waste production. By conservative estimates, the DENR reported that all the country's SLFs would reach capacity by 2029.

Phase V: A New Beginning (2019-Present)

2019-23: During recent years, the Filipino sanitation sector has not only been developing at a drastically faster pace, but in an array of diverse, creative directions. In 2019, the San Miguel Corporation (SMC) broke new ground by using 900 kilograms of commercially sourced plastic to pave 1.5 kilometers of road in the NCR. In 2020, Quezon City paid retributions of \$3,800 US to every victim heir of the Payatas collapse (Pulta, 2020). The following year, the DENR reported that every illegal dumpsite nationwide had been closed; there are now 237 operational SLFs and 11,637 MRFs nationwide (GOVPH, 2021). In 2022, the Extended Producer Responsibility Act (RA 11898) was enacted, furthering the engagement between ‘sachet multinationals’ and SWM (Howell, 2023). In 2023, the San Miguel Foundation built a skills and learning development center where the infamous Smokey Mountain dumpsite used to stand; the Payatas landfill had been transformed into a cyclist-friendly park (Argosino, 2023).

Despite these achievements, only 60% of MM’s 9,498 daily tons of solid waste are collected, let alone properly disposed of; in comparison, Jakarta collects 74% of its waste, and Bangkok 81% (Reyes, 2023). Financial inefficiency continues to pervade the sector; since 2018, the Metropolitan Manila Development Authority (MMDA) has increased its spending on sanitation by 84%, yet 15% of its solid waste still lands in Manila Bay (Reyes, 2023). The country now produces over 16 million tons of solid waste per year; unfortunately, some 400 LGUs have yet to create a SWM plan and 3,400 firms have yet to comply with the EPR Act (Reyes, 2023). In order to avoid a relapse of crisis, institutional incentives must be reformed and infrastructural inefficiencies must be remedied.

6.0 Historical Context and Policy Failures

6.1.1 Policies Implemented

Republic Act 9003: the Ecological Solid Waste Management Act of 2001

The Republic Act 9003 provides a systematic and comprehensive adaptation of SWM in the Philippines. The Act mandates the segregation of waste, composting, and recycling under the leadership of LGUs. Its major provisions include the implementation of sanitary landfills, recycling centers, a national ecology center, training, networking services, the closure of open dump sites, the formation of solid waste management boards and multipurpose environment cooperatives (YU, 2006).

The Act recognizes LGUs as primary implementers and requires them to provide ten-year SWM plans. This includes the establishment of NSWMC to provide technical support and policy in support of the national solid waste management program. The Act states that the local government is to collect nonrecyclable materials and barangay units are responsible for collecting and organizing compostable, reusable and biodegradable waste; however, the common practice is through house-to-house collection (Premakumara, 2013).

Republic Act 8749: Philippine Clean Air Act

The Clean Air Act, enacted in 2001, offers incentives to local government units (LGUs), businesses, private organizations, and individuals for initiatives that enhance air quality management and reduce pollution. It promotes efforts such as Emission Reduction Facilities (ERF²), cleaner production methods, and technologies that avoid burning carbon-based materials (Asian Development Bank, 2014).

This act mandates all government agencies to follow an integrated air quality framework, emphasizing the "polluters must pay" principle. It bans the use of incineration for disposing of municipal, biomedical, and hazardous waste, as this process releases toxic fumes. The act also compels LGUs to foster segregation, recycling, and composting practices within their regions and required the elimination of incinerators by July 2003. The act also establishes a research program for developing air pollution reduction technologies and techniques. It prohibits incineration and public smoking, and at the local level, governments can set emission quotas and are encouraged to develop recycling programs (Asian Development Bank, 2014).

6.0 Historical Context and Policy Failures

6.1.1 Policies Implemented

Republic Act 11898: Extended Producer Responsibility Act (EPR)

The EPR Act holds private and public institutes responsible for the waste they generate. This policy aims to incentivize “a more sustainable, circular economy by rethinking product design, re-usability of items, and recycling collection rates” (Howell, 2023) Producers can fulfill their responsibility either through financial contributions or by conducting plastic waste collections.

Each country has distinct regulations, the EPR Act was passed in the Philippines on July 23, 2022. This legislation makes companies responsible for all packaging phases, including protection, transportation, and selling of the product, affecting both upstream and downstream business operations. This is a crucial shift from the previous focus solely on production impact. Unique to this Philippine law is the inclusion of flexible plastic recovery, encouraging the collection of historically non-recyclable waste. This law officially took effect in January 2023, six months after its introduction (Howell, 2023).

The EPR Act of 2022 in the Philippines primarily affects large enterprises with assets over ₱100 million. These companies must either create an EPR program or start phasing in plans for plastic packaging management. However, the law currently does not obligate small and medium-sized enterprises with assets between ₱3 million and ₱100 million, although their participation is encouraged if financially feasible (Howell, 2023).

Republic Act 7924: Metropolitan Manila development authority act of 1995

The Metropolitan Manila Development Authority (MMDA) was established to supervise and execute metropolitan-wide services including traffic management, flood control, and solid waste management, among other responsibilities. Its implementation involves developing strategies and initiatives for sanitary waste disposal, creating sanitary landfills and associated facilities, and advocating for waste reduction, reuse, and recycling. The MMDA aims at providing a supervisory authority “within Metro Manila without diminution of the autonomy of the local government units concerning purely local matters” (Congress of the Philippines, 1955)

6.0 Historical Context and Policy Failures

6.1.2 Identification Of Failures

Republic Act 9003: the Ecological Solid Waste Management Act of 2001

Over two decades have passed since the implementation of RA 9003 and yet the law awaits serious implementation. Despite the RA 9003 recognizing LGUs lead implementers, they have failed to comply with several of the required provisions, most notably; the closure of all open and controlled dumpsites, the establishment of Materials Recovery facilities and the implementation of Ten-Year SWM Plans (Oandasa 2023) Additionally, few local governments are familiar with their responsibilities, “the timetable is behind schedule, source reduction and segregation efforts at the local level are sporadic and uneven, and there is little active public participation, understanding, or interest” (Asian Development Bank).

The following factors are obstacles for the effective implementation of RA 9003 in the aspect of SWM financing, incentives and cost recovery:

- Inadequate and inconsistent funding allocations for solid waste management (SWM).
- Lack of establishment of a National Solid Waste Management Fund.
- Extensive documentation required by Government Financial Institutions for funding access.
- Improper allocation and use of allocated funds.
- Limited engagement and collaboration with private sector entities.
- Transitioning from government-subsidized to cost-recovery-based SWM services.
- Reluctance of households to pay for SWM services.
- Significant investment costs associated with new technologies and processes in SWM.
- Absence of comprehensive cost accounting practices at the local government unit level.

While some cities and municipalities have successfully fulfilled their responsibilities, numerous other local government units (LGUs) have fallen short due to factors such as political dynamics, differing levels of resource availability, and a limited understanding of Solid Waste Management (SWM). The GIZ SWM4LGUs Project points out that these issues are intensified by the regular turnover of SWM officers during political shifts. This problem is further complicated because establishing a local environment and natural resources office (ENRO) is not a compulsory requirement under the Local Government Code (LGC), but rather an optional measure (Asian Development Bank, 2014).

6.0 Historical Context and Policy Failures

6.1.2 Identification Of Failures

Republic Act 9003: the Ecological Solid Waste Management Act of 2001

Local government units need to re-evaluate their commitment Solid Waste Management and prioritize the implementation of RA 9003, its effectiveness as a solution for SWM issues remains more uncertain than clear. Despite achieving an average waste diversion rate of 42%, Metro Manila continues to dispose of mixed waste at dumpsites in Navotas, San Mateo, and Rodriguez. The situation is further complicated as many newly established SLFs and MRFs, including those in Boracay and various LISCOP sites, as well as those developed with KfW assistance, have essentially become open dumps.

St. Rosa serves as an example of the low commitment to the Republic Act. It was one of first HUCs to have an approved 10-Year SWM plan “that created a CENRO with a separate office right after the effectivity of RA 9003. 27 ” (Asian Development Bank, 2014). This city might have not only been the first, but the only HUC in the Philippines to implement the Environmental Code. Effective SWM demands a strong and sustained commitment from LGUs. Even with successful implementation, maintaining a sustainable SWM system remains a challenge. This has led to the exploration of Public-Private Partnerships (PPPs) in municipal SWM. While the principles of reduce, reuse, and recycle (3Rs) are fundamental to SWM, they alone may not be sufficient for handling bio-waste and residuals, which constitute around 60% of waste, showing the complexity of the issue and the need for more comprehensive and innovative strategies in waste management (Asian Development Bank, 2014).

The following are statistics 13 years after the implementation of RA 9003 :

- The NSWMC received 557 out of the required 1,635 municipal SWM plans,
- of these, 43 were approved.
- Waste segregation at source and segregated waste collection were implemented only in a few LGUs and not on a nationwide scale.
- Solid waste collection was largely limited to the urban sector of the population and reportedly varied from 15% to 90% in efficiency.

Despite the low efforts from LGUs, Barangay Solid Wastes Management Committee as well as the City Solid Wastes Management Board are very engaged in the implementation of SWM in the city. Additionally, the city council provides support “and has in fact passed Ordinance 1720-2011 or the Environmental Code of the City of Santa Rosa to support the implementation of RA 9003 and other environmental initiatives of the city” (Asian Development Bank, 2014).

6.0 Historical Context and Policy Failures

6.1.3 Contributing Factors

Population Growth

The rising production of solid waste is exacerbated by population growth and economic activities, posing a major concern for its impact on human health and the environment. From 2000-2007 the estimated population of the Philippines stood at 94 million, with an annual growth rate of 1.95%. In 2009, it was reported that the region generated between 0.30 and 0.684 kilograms of solid waste depending on the socio-economic status/level of the region. The National Capital Region (NCR) declared the highest waste generation rate of 0.71 kg per capita per day, and the ARMM with 0.30 kg per capita per day. Using these figures, it was estimated that the total waste produced stood at around 35 tons per day or 13.1 million tons per year. This surge in waste has significantly contributed to environmental problems, with the total waste generated estimated to have led to greenhouse gas emissions of approximately 1.6 billion tonnes. In 2016 alone, an alarming 242 million tonnes of plastic waste were produced, with 12% coming from municipal sources. Out of this, 40% were directed to landfills and 33% were discarded in open dumps, causing ecological harm. Only 19% of this waste was processed through recycling or composting, the rest incinerated.

Hazards

Dump sites are dangerous and pose several health hazards. Waste is often handled by poorly trained and equipped people that are at risk of being exposed to toxic chemicals such as 'leachate'. This contaminant often infiltrates the groundwater, a source of drinking water, and flows into nearby river systems and Manila Bay, impacting fisheries. Over 4,300 waste pickers work in these dangerous and unsanitary sites, which lack adequate safety measures like proper fencing and signage. Furthermore, the absence of essential waste encapsulation practices, such as daily soil cover and final cover systems, results in most dump sites having exposed, uncovered waste, presenting major environmental and health threats (Asian Development Bank, 2004).

7.0 Status Quo Analysis

7.1 Economic

With the lack of institutional capacity and enforcement of the aforementioned waste management policies, economic costs are incurred by the MM residents and government. As levels of acute diarrhea increase, morbidity and illnesses persist within MM due to the unsanitary environment. This brings about economic costs in the health sector through “hospitalization, medical costs, and foregone income due to reduced workdays” (National Solid Waste Management Status Report, 2018)

“Attention has started to be drawn to the financial inefficiency of the sanitary sector; the cost to collect and dispose waste in MM averages 1,450 pesos per ton, yet less than 25 pesos are collected per capita” (MM SWM Project, 2003). The unmet demands of policies such as the RA 9003 act bring about the same issue of increased costs of recovery and cleanup of the mismanaged waste. This poses an economic burden on the LGU’s budget that can be reallocated to more efficient and sustainable SWM projects/initiatives.

Due to the lack of consistent integration of Green Public Procurement (GPP) and 3 R’s within all sectors of society in MM, natural resources such as land and bodies of water are being overconsumed (Department of Environment and Natural Resources, 2018). Through evaluating the concept of overconsumption, one can clearly identify the vast economic potential and savings that can be acquired with addressing waste mismanagement. These savings include the use of compost materials instead of commercial fertilizers, and the savings that can be sustained by the health sector.

Moreover, since there are still areas of MM that illegally operate and manage waste through incineration, it is evident that it “precludes economic development and job creation” (Yu, Serrona, 2006) . This is due to the process’s low demand for employees to conduct the process since it is not labor intensive. This reflects the high opportunity cost of the operating incineration sites in comparison to switching to more sustainable and labor intensive methods which can employ more. On the other hand, in relation to the implementation of Waste to Energy (WtE) technologies, it is evident that there is a clear reluctance from private investors to invest due to the associated financial risks and uncertainty of market and non-market factors. These include the presence of policy conflict since there is an overlap between integrating WtE technologies and the Clean Air Act which prohibits the burning of MSW (C.B. Agaton, et al., 2020). Hence, this reluctance towards investing in technologies poses a threat to the economic potential of SWM strategies.

7.0 Status Quo Analysis

7.2 Ecological

Improper SWM has a pervasive effect on the local and global community. Families and residents that live near or within dumpsites are especially vulnerable to a range of diseases. As mentioned, the leachate from solid waste “can contaminate groundwater tables and surface waters” (National Solid Waste Management Status Report, 2018). This negatively affects aquatic ecosystems and threatens marine life. In addition, with the presence of illegal open dumpsites, the presence of insects and pests is not sustained. Insects and pests act as disease vectors, and hence can spread disease across to humans and animal ecosystems as well. Moreover, methane gases from dumpsites can contribute to pollution, climate change and global warming. The release of methane gas stems from the decomposition of organic waste in landfills. “Improperly managed solid wastes also can result in increased flooding and destruction of infrastructures due to clogged waterways” (National Solid Waste Management Status Report, 2018). This can potentially further impact the agricultural industry through reduced crop yields.

7.3 Social

As for the societal implications associated with improper SWM, it is evident that an estimated average of “27% of the municipal population might be at risk from water-borne diseases due to open dumpsites”(National Solid Waste Management Status Report, 2018). Therefore, experts within the NSWMM report indicate that it can be assumed that a great proportion of diarrhea cases in MM are solely attributable to solid waste pollution. The higher risk of disease spread threatens public health, increases morbidity rates. In turn, this could reduce productivity levels and increase stress levels within the population. Moreover, methane gases released from dumpsites can also affect the health of exposed populations. This consequence could result in the further displacement of individuals living around the landfill. Further, if the disposal of waste illegally along coastal areas and bodies of water persists, the litter will have an impact on the city’s urban aesthetics, and in turn the quality of life of residents.

8.0 Policy Alternatives

Note on RA 9003

Despite the overwhelming focus bestowed upon the failures of RA 9003, we don't ascribe these failures to the policy itself, but rather toward the political incentives, social conditions, and economic constraints that have limited the compliance and implementation of RA 9003. Consequently, our policy alternatives and recommendations are tailored for policies that are less focused on what an ideal end result might look like for the Philippine's sanitation sector, and more focused on enabling specific, pragmatic mechanisms of change.

#1 - The Magna Carta of the Poor (RA 11291)

In the Philippines, the informal sector not only accounts for over 15 million members of the work force, but yields significant economic contributions to the sanitation sector. Unfortunately, the importance of these workers is unacknowledged and delegitimized, effectually marginalizing these locals to lives of poverty. The Congress of the Philippines proposes that the purpose of RA 11291 is to "uplift the standard of living and quality of life of the poor and provide them with sustained opportunities for growth and development"; we posit that the best way to do so is to add legally protect the wages and working conditions of waste pickers.

#2 - Amending Public-Private Partnerships (RA 11966)

As the name suggests, Public-Private Partnerships (PPP) entail the collaboration between government agencies and private sector companies in the delivery of a project that is usually solely managed by the government; in the case of SWM, these projects could include any infrastructure related to the recovery, diversion, transportation, or repurposing of solid waste. In comparison to wholly public or private initiatives, PPP's are often able to push efficiency and innovation to greater heights, as the financial risks are distributed across multiple entities. RA 11966 was enacted to stimulate investment into PPP's; however, considering the current pace of infrastructural development across the Philippines, we believe the scope and incentives of this policy should be adjusted. Our analysis suggests that sector specific tax subsidies should be applied to the construction of SLFs, MRFs, WTE facilities, and other sustainable waste refineries or facilities. Currently, special incentives only apply to projects valued above P15 billion; despite not coming close to this market capital, it's evident that these facilities yield tangible environmental and social benefits. By expanding the scope of RA 11966, the budgetary restraints of the DENR and MMDA might be aided via PPPs.

9.0 Recommendations

9.1 - Invest in Specialized Infrastructure

Metro Manila's ecosystem of SLFs and MRFs is a clear improvement from what was in place 20 years ago. However, many of the region's solid waste related issues show no signs of diminishing under the status quo: LGUs are minimally incentivized to comply with legislation; employment opportunities under SWM are low status and low paying; national institutions are struggling to harness the strategic and material advantages Metro Manila has to offer. To highlight how specialized infrastructure solves these issues on multiple levels for nearly all stakeholders, we will dissect the US-based Wastefuel's initiative to build a bio refinery for aviation fuel in Luzon.

First and foremost, there is huge demand for aviation fuel not just in the Philippines, but all over Asia; Singapore, Thailand, and Hong Kong are some of many countries that could be prime customers for exported fuel from Metro Manila. In 2019, Asia demanded over 50 billion gallons of aviation fuel (Masigan, 2019); tapping into this market could enable the Philippines to bolster their domestic industries and move away from external aid dependence.

One bio refinery is estimated to generate 23 million gallons of fuel every year; given Asia's high demand, exporting this fuel would yield nearly P7.5 billion dollars annually, while simultaneously processing 3,500 tons of solid waste per day (over one third of all the waste produced in Metro Manila!). Furthermore, Wastefuel claims that its bio refinery would create over 200 jobs in engineering and science; not only would this boost human capital, but it would earn the government another P415 million in income taxes.

Wastefuel's technology is also better for the environment than other methods of waste disposal. Their process complies with the Clean Air Act, it does not involve incineration, and its production creates only 20% of the carbon emissions brought by an equivalent quantity of fossil fuels.

MRFs and SLFs are extremely useful, and have prevented any relapse of the waste crises seen at the end of the 20th century. However, given their current rate of implementation and processing capabilities, government authorities must consider more specialized developmental approaches that take advantage of the many characteristics that make the Philippines, especially Metro Manila, stand out.

9.0 Recommendations

9.2 Legitimize the Informal Sector

38% of the Filipino working population earns their wages within the informal sector; these 15.7 million individuals are self-employed, entrepreneurial, and integral to the Philippines' economy. In Metro Manila, Linis Ganda's eco-aide program collected 4.5% of all waste produced, generated \$10 million US in wages, and saved LGUs \$660 million US in the process; with the support of the DENR, MMDA, or other SWM-adjacent institutions, programs like this could be scaled indefinitely.

There are several advantages presented by the informal sector that are not displayed by the dominant private sector. Firstly, eco-aides are incentivized to collect and divert waste efficiently and effectively. Due to sheer neglect, SLFs often take in tons of waste that could have been recycled or repurposed elsewhere; in fact, as long as it weighs more, SLF owners earn more tipping fees regardless of what is disposed of at their facility. On the other hand, co-aides earn their wage by selling materials to junk shops, who then sell bundles of materials to industry dealers; bolstering the informal sector could rapidly transform waste into capital, perhaps at an even faster rate than specialized infrastructure.

Additionally, circulating more funds into the informal sector would stimulate the lowest socio-economic brackets and, in effect, work around the infamous "not in my backyard" attitude. Filipino citizens who are employed outside of the sanitation sector have every reason to protest the opening of an SLF or MRF near their home, where as an unemployed individual might be able to make a living out of a new piece of waste infrastructure.

Finally, eco-aides are able to spread geographically much quicker and cheaper than SLFs, MRFs, and the garbage trucks that trail along. The archipelagic nature of the Philippines pose constant challenges against the mobility of the sanitation sector; as of now, only 55% of waste is collected at all. Furthermore, many smaller, rural areas are opposed to the notion of loud garbage trucks intruding their streets. Instead of battling with locals over the construction of more landfills, it may be worth funding a handful of eco-aides with pushcarts. These workers proudly keep their streets and waterways clean, as well as save LGUs a considerable sum of budgetary spending and administrative hassle; its time to compensate the informal sector in accordance for their service.

10.0 Barriers to Action

Local Government Units

Local Government Units in the Philippines face significant challenges in Solid Waste Management, they are hold “responsibilities without resources and capacities” (Asian Development Bank, 2014). Legislation such as the LGC and the RA 9003 places them at the forefront at addressing the SWM crisis. They are tasked with several responsibilities to plan, manage, and implement local development without the necessary resources.

The following are the key challenges in SWM for LGUs in the Philippines (Asian Development Bank, 2014)

- **Lack of Essential Guidelines:** Most cities, municipalities, and provinces do not have basic guidelines for strategic Solid Waste Management (SWM) planning and operation.
- **Deficient Data Systems:** There is an absence of reliable data systems needed for effective SWM planning and execution.
- **Cost Minimization Strategy:** A key principle for reducing SWM service costs is the establishment of a separate account specifically dedicated to SWM.
- **Inadequate Private Sector Engagement:** There is poor involvement of the private sector, especially in the application of new technologies, within the SWM sector.
- **Investment Shortfalls:** Due to limited private sector engagement, investments in SWM services have been insufficient. This has led to challenges in adequately responding to the increased and evolving demands on SWM services and infrastructure.

Solid Waste Management (SWM) practices often suffer from a lack of long-term, strategic planning, leaning more towards short-term, unsustainable solutions. This issue stems primarily from the limited abilities of LGUs to finance SWM initiatives and enforce relevant environmental laws effectively. The situation is further strained by the implementation of highly technical policies, programs, and plans such as the Clean Air act and the RA 9003. Despite these challenges, LGUs have recently made significant progress in establishing SWM plans. As of December 24, 2021, the National Solid Waste Management Commission (NSWMC) had approved the solid waste management plans of 1,171 Local Government Units (LGUs), which is about 68 percent of its target nationwide representing a substantial improvement compared to 3.4% approved SWM plans in 2014 (Asian Development Bank, 2014)

11.0 Winners and Losers

Local Government Units - **Winners**

LGU officials, especially within Metro Manila's unique autonomy, have complete discretion over how they handle their SWM systems. While it may be true that the protocols which benefit local residents are the same protocols that would save LGUs money, the fact remains that the LGU not only has the final say, but will most likely face minimal consequences should they make a wrong decision.

Local Communities and the Informal Sector - **Losers**

Various informal or external organizations, such as the Linis Ganda Foundation or the VMSDF, have done tremendous work toward improving public awareness, keeping streets and waterways clean, and even saving LGUs money. Unfortunately, these groups have yet to be compensated fairly for their service. In 2004, Linis Ganda's eco-aides collected 4.5% of all waste produced nationwide, effectively saving LGUs over \$660 Million US (Medina, 2007); despite this feat, eco-aides remain some of the poorest slum dwellers in the country. Institutions have no incentive to improve their livelihoods; these workers are essentially employed in a waste monopoly.

International Donors and Corporations - **Winners**

Wealthier nations haven't much to lose when extending support to nations like the Philippines. Donor initiatives curry domestic support and improve diplomatic relations, often at the cost of less than one percent of the federal budget; multinational investors unlock cost effective labor markets and strategic entry into the Asia-Pacific region when working through Metro Manila.

Private Waste Management Sector - **Winners and Losers**

In order to stay in business, private waste facilities depend on being contracted by LGUs and, in effect, the tipping fees that cover their maintenance costs. On one hand, these facilities are invariably in high demand, and once a relation is built with an LGU, these companies often enjoy industry security. However, these companies are not only in constant competition with each other, but also with newer pieces of infrastructure, such as the WTE facility built in Rizal; any waste sent to other facilities equates to lower tipping fees for the existing private companies, which is especially relevant as technological innovation continues to accelerate.

12.0 Trade-Off Analysis

12.1 Economic

Tipping Fees

Tipping fees are paid by LGUs to SLFs when disposing waste at their facility. In Metro Manila, this fee is typically P600 per ton, and is often subsidized by the MMDA. Landfill owners depend on these fees to recoup their initial investments and maintenance costs. Herein lies the problem; more innovative solutions, such as WTE facilities, drain the tipping fees from existing landfills. Mayors and council members also typically have private contracts and relationships with these landfills, further impeding the diversion of any tipping fees away from the status quo.

12.2 Environmental

Single Use Plastic Ban

Metro Manila's consumer market can be described as a "sachet economy"; most products are sold in small, affordable, individually packaged quantities, conveniently sold in 'sari-sari' markets in nearly every barangay. It's no surprise that this contributes hefty amounts of plastic to Metro Manila's waste cycle; it seems equally evident that banning single use plastics could solve this problem. However, in order to feasibly enact a ban of such proportions, somebody must shoulder the cost of less convenient packaging; as in most cases, this cost falls onto the local residents. RA 9003 specifies that before banning any item, an alternative must be found that does not exceed 110% of the original cost; this is easier said than done, as some proposed alternatives have cost as much as three times the original price.

12.3 Social

Not in My Backyard (NIMBY)

Filipinos largely concur that there is insufficient collection, disposal, and overall control over SWM; most barangays still don't have access to an MRF or an SLF. However, proximity to these facilities invites noisy garbage trucks, greater risk to leachate poisoning, and a friendly community of waste pickers. Paired with the lack of faith most citizens hold in their LGU's ability to improve welfare, most initiatives to build more facilities are met with opposition from the same stakeholders who need them most.

Methodology

Our analytical approach can be categorized by four distinct pillars of focused research:

Historical and Demographic Context Analysis

We explored the dynamic patterns of population, migration, and institutional evolution within Metro Manila, drawing insights regarding how solid waste management has been handled under differing conditions of various time periods; by identifying notable historical events and tracing the quantifiable data relevant to that period of time, we discovered the foundations of what is now the status quo. Much of our analysis is included within our chronological timeline, as we believe the format lends a clear, distilled interpretation of the market failure (Appx. 3).

Policy, Governance, and Disaster Response Review

To best understand the the various Republic Acts that have been passed in hopes of improving Metro Manila's sanitation sector, we analyzed each policy in three phases: first, we determined the initial motivations behind the RA's enactment; then, we looked for key events that took place during the process of enactment; finally, we evaluated the potential implications of both compliance and non-compliance, specifically highlighting which conditions may be telltale signs of impending crisis.

Assessment of Socio-Economic Health and Stability

With every political invention and infrastructural development, we considered which stakeholders became 'winners' following the aftermath of the transformation, and which effectively 'lost' under the new status quo. We strived to dissect the challenges and advantages specific to each respective stakeholder, as well as define, measure, and integrate the indicators that may confirm whether positive changes in welfare are being made.

Comparative Evaluations of Sustainable Infrastructure

Considering the rapid pace of action undertaken in recent years, we valued the calculation of long term costs and benefits of various progressive developments in infrastructure and technology; as our research progressed, we found that interdependence between different forms of infrastructure (e.g. MRFs and SLFs) proved to be invariably important.

Objectives

The purpose of our research can be categorized into three broad sections:

Analyze the past, present, and future capacities and behaviors of key stakeholders

- Define the realistic parameters and indicators of positive changes in welfare
- Investigate the roles of political leadership, public action, and international support
- Recommend potential incentives and disincentives to enforce existing policy

Assess the sanitation sector's resilience and responsiveness to disaster

- Lay out the inefficiencies and limitations of the current SWM system
- Evaluate how the aftermath of past crises could have been handled differently
- Offer actionable insights concerning the current risk management protocols

Evaluate the costs and benefits of infrastructure developments, international aid programs, community organizations

- Assess Metro Manila's true budgetary constraints, outside of political inaction
- Encourage greater community involvement within longstanding, sustainable programs
- Highlight successful approaches and innovations that merit greater investment and research

Ultimately, our goal is to identify the barriers obstructing productive developments within the status quo and, in effect, create a base of research that can be used to facilitate a platform for change.

Concluding Remarks

In studying the progression of Metro Manila's solid waste management over the past 60 years, three salient points stand out from the rest. First, incentivizing LGUs has proven to yield greater results than attempting to hold them further accountable. Although this dynamic is evidently suboptimal, the fact remains that too many blatant loopholes and vested interests exist within the status quo for any realistic penalizing of LGU noncompliance; it's much easier to convince an LGU to invest in an SLF by promising them tipping fees, as opposed to relying on ambiguous threats that are difficult to enforce.

Secondly, when planning larger projects that are costly and committal, the Philippines must take full, strategic advantage of its environmental and geographical attributes. The country's archipelagic nature holds a diverse catalog of resources and micro-climates, viable for fueling of WTE facilities; extensive coastlines present ideal ports for transporting renewable energy across Asia; even the high rainfall could be harnessed to clear waterways and enhance composting infrastructure.

Finally, improving solid waste management should be perceived through the lens of improving human capital; in other words, millions of the Philippine's poorest residents are already massively enhancing the country's sanitation sector, indicating that within this demographic lies tremendous, untapped civil potential. By investing in a handful of push carts, training seminars, and ideally an eventual policy amendment for fair compensation, LGUs can transform an unemployed slum dweller into an active driver of progressive change. Eco-aides symbolize the possibility of reviving the communal values rooted deep in Filipino culture; once the public has faith that they have the capacity to enact change, they will mobilize themselves without hesitation. We are already witnessing this take place on a relatively small scale; should government institutions choose to stand behind their marginalized communities, tens of millions of freshly motivated, locally sourced employees will spring into the workforce.

UBC's Food and Resource Economics Team extends their sincere acknowledgements to Professor Sean Holowaychuk, for his continued guidance and support since the early stages of this policy report, and the Department of Environment and Natural Resources, for their devotion toward tackling some of the longest standing obstacles that the Philippines have faced throughout the past 50 years.

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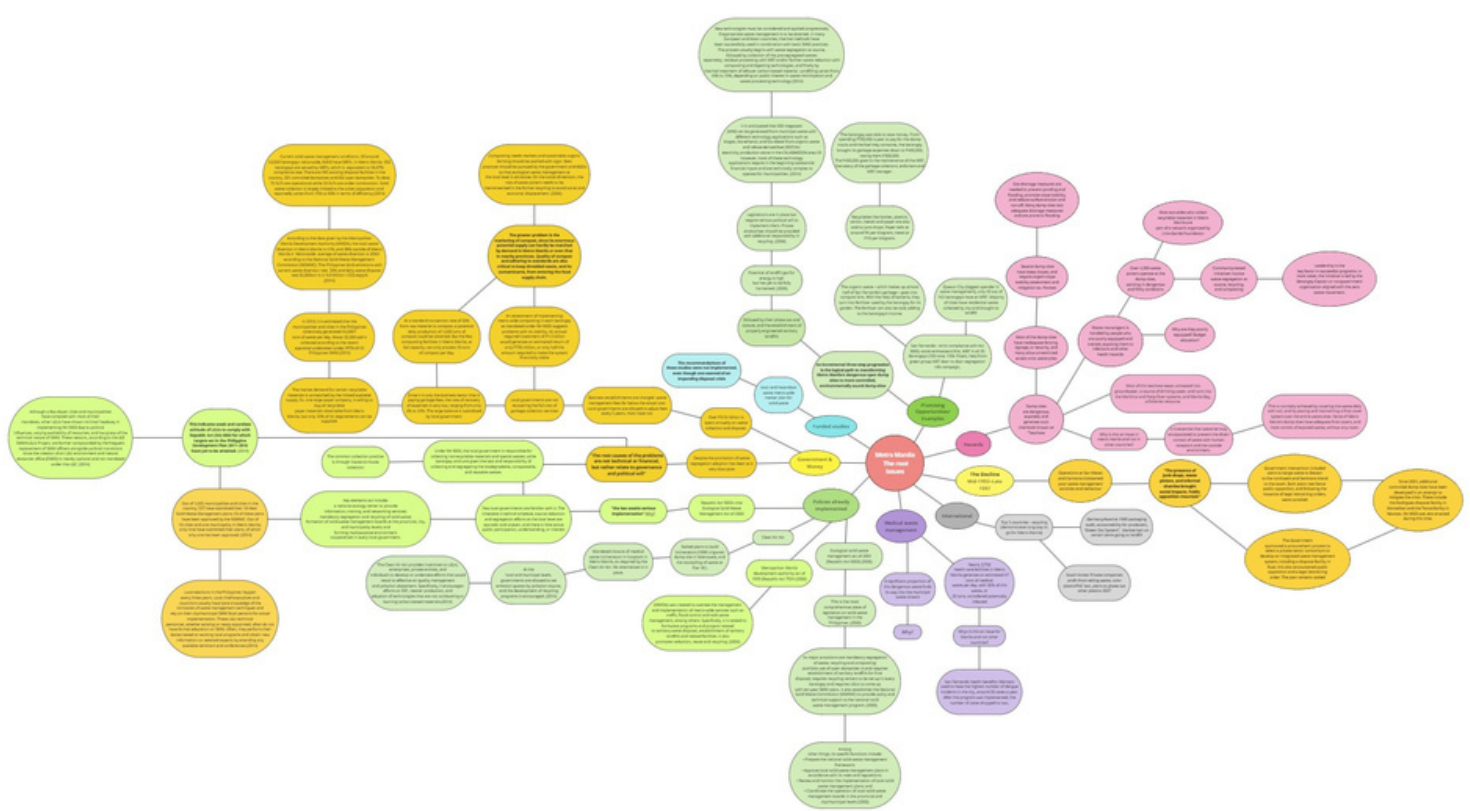
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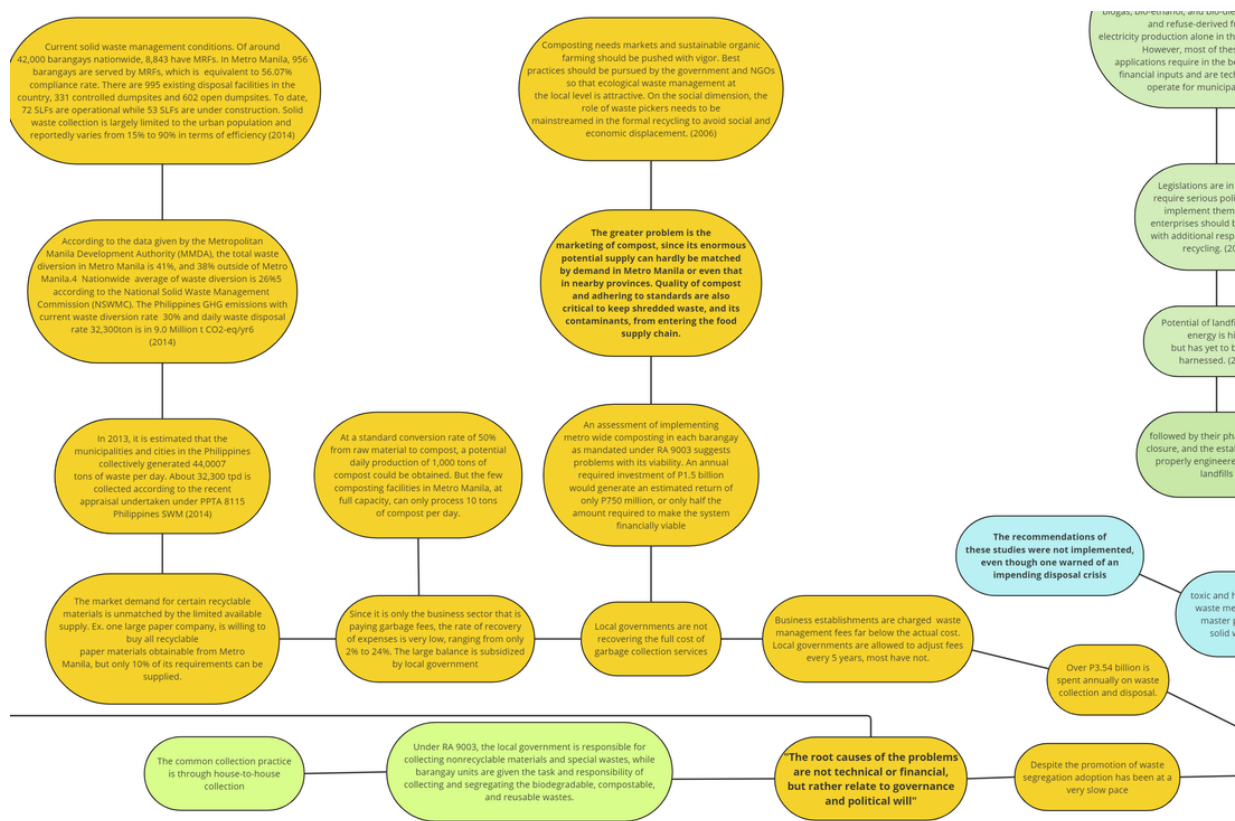
Policy Action	Economic Efficiency	Ecosystem/ Environmental Management	Equity or Distributional Effects (Social and Health)	Institutional Regulations and Priorities
Status Quo	Business establishments are charged waste management fees far below the actual cost. Over P3.54 billion is spent annually on waste collection and disposal. Only the business sector is paying garbage fees; the rate of recovery of expenses is very low, ranging from 2% to 24%. The large balance is subsidized by the local government. The market demand for certain recyclable materials is unmatched by the limited available supply. Quezon City (biggest spender in waste management), only 40 out of 142 barangays have an MRF. Majority of cities have residential waste collected by the city and brought to landfill.	Dump sites lack engineered control systems. They seriously damage the environment, threaten public health, and cause significant social impacts. At a standard conversion rate of 50% from raw material to compost, a potential daily production of 1,000 tons of compost could be obtained. But the few composting facilities in Metro Manila, at full capacity, can only process 10 tons of compost per day. The organic waste (almost half of San Fernando's garbage) goes into compost bins. With the help of bacteria, they turn into fertilizer used by the barangay for its garden. The fertilizer can also be sold, adding to the barangay's income. Clean Air Act: air quality has improved from 2022 - 2023 (43 -> 40 ug/nm particulate matter (PM10))	San Fernando - strict compliance with Act 9003, social enthusiasm first, MRF in all 35 Barangays (100 total, 150k P/per), help from green group MEF door to door segregation info campaign. Nearly 3,700 health care facilities in Metro Manila generate an estimated 47 tons of medical waste per day, with 56% of this waste, or 26 tons, considered potentially infected. Incidence of water-borne diseases is closely linked to poor SWM and sanitation access. Although septage is collected, generally by private collectors, there is little or no treatment due to the absence of appropriate facilities. Septage thus is dumped in an uncontrolled manner in waterways, dumpsites, or agricultural lands. Service providers are required by law to do wastewater treatment, but regulation and monitoring are inefficient; thus, investment is seldom undertaken and proper treatment is rare.	Local governments are allowed to adjust waste management fees every 5 years, most have not, failing to recover the full cost of garbage collection services. RA 9003 includes: a national ecology center to provide information, training, and networking services; mandatory segregation and recycling of solid waste; formation of solid waste management boards at the provincial, city, and municipality levels; and forming multipurpose environment cooperatives in every local government. The composting mandate within RA 9003 is assessed as unviable; an annual required investment of P1.5 billion would generate an estimated return of only P750 million. Out of 16 cities and one municipality in Metro Manila, only nine have submitted their plans, of which only one has been approved.
Amendment of Existing Policy	- Prepare and implement long-term financial plans setting out required capital and recurrent expenditures over a 10-year planning period. - Expand the local government's role to provide monitoring and enforcement of required standards. - Measures to address deterioration and depreciation of machine quality and productivity (to address aging collection trucks, limited number of waste bins, absence of proper disposal sites...etc.)	- Urgent stability assessments and mitigation for the Payatas and Rodriguez sites and Leachate mitigation at the Payatas and Tanza sites - Improve contracting procedures, regulate private sector waste disposal performance, and improve record keeping and access to information - Cease dumping and construction at Lupang Arenda and the provision of emergency measures to protect the communities living on the waste - Cease housing construction over waste at the Bagumbong (private) site	- Informational and Educational Campaigns to improve recycling consciousness - Establishment of training programs to ensure effective and efficient management of SWM units with technically capable staff - Post-closure maintenance of dumpsites - Extended enforcement of Producer Responsibility policies to mitigate consumerism externalities	- Strict compliance and enforcement measures to ensure the implementation of RA 9003; monitoring and Evaluation system installed by external institution - Partnership and communication between waste pickers, NGOs, community organizations, private enterprises and LGUs must be facilitated through; joint ventures, local sustainable development projects, multi-stakeholder initiatives, alliances and relationships of mutual trust. - Sourcing capital investment funds to establish Sanitary Landfill Facilities (SLF), establishment of National Solid Waste Management Fund (NSWMF)
Formulation and Enactment of New Policy	- Post-closure measures to ensure that dumpsites do not put at risk the health and safety of residents. Potential ideas include transforming closed dumpsites into public parks/spaces or energy generation facilities to engage more members of the community. This can be a source of job creation, and sustainable energy generation.	- Introduce the concept of sustainability into financial management procedures, and continue to search for innovative methods of financing - Manage opportunities of utilizing methane gas from dumpsites to generate electricity and further use as organic fertilizers for sustainable farming	- Facilitating monitoring and evaluation systems within the private sector, civil society and LGUs.	Long-Term Solid Waste Disposal Program; - Formulate dump site closure plans followed by post closure maintenance for at least 10 years. - Urgently develop long-term, regulatory-compliant regional sanitary landfill facilities. - Expand existing dump sites needed on an emergency, short-term basis, which must be properly designed with environmental protection systems, and be fully integrated with the proposed short-term improvements - Improve contracting procedures, regulate private sector waste disposal performance, and improve record keeping and access to information - Improvement of Government's database

Appx. 2, Policy Matrix and foundations of solution analysis

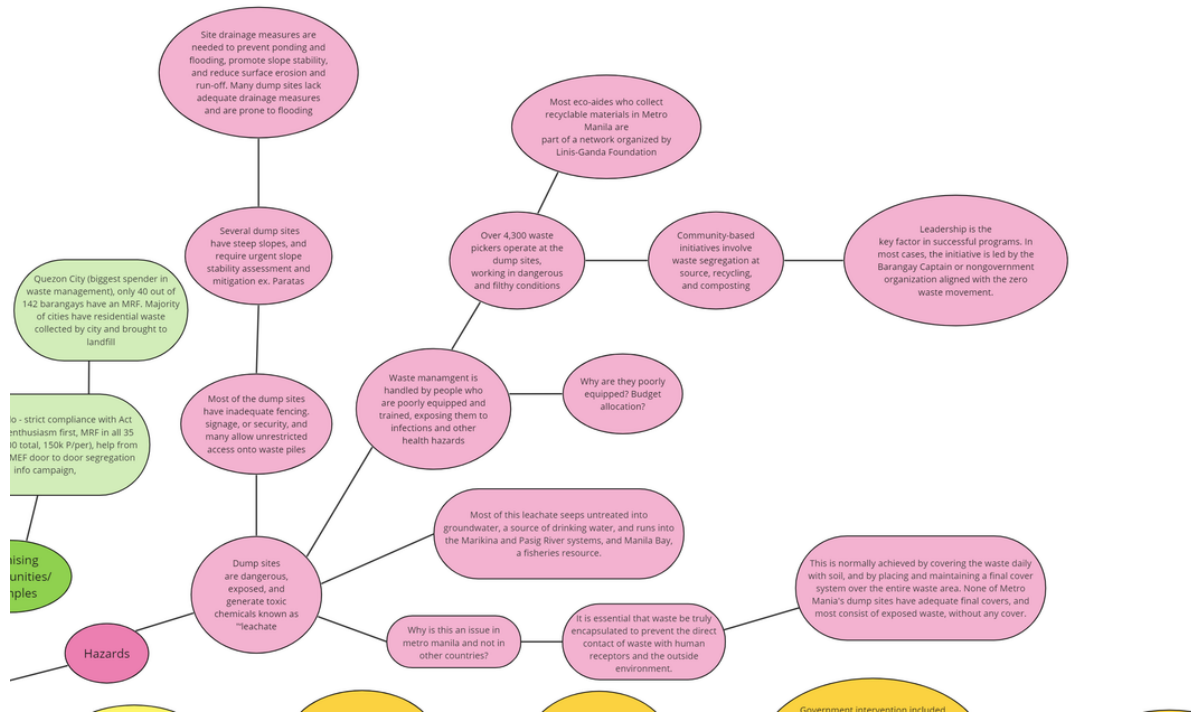


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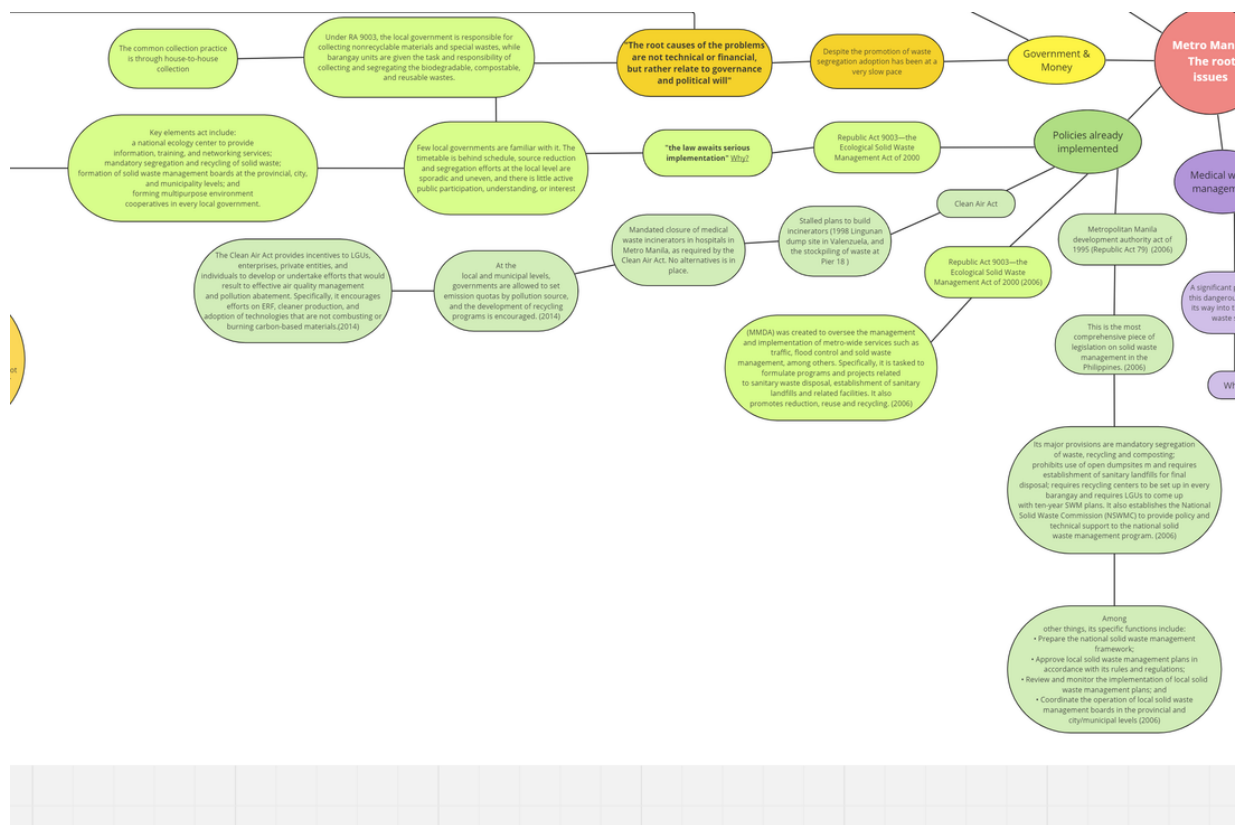
Appx. 3, Mind Map of Market Failure



Appx. 3, Mind Map of Market Failure, Government and Money



Appx. 3, Mind Map of Market Failure, Hazards



Appx. 3, Mind Map of Market Failure, Policies Already Implemented

