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Waste Management in Metro Manila Food Markets: Rapid assessments in Quezon City and Pasay City

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Resilient Cities through Sustainable Urban and Peri-Urban Agrifood Systems

Work package: Building inclusive and sustainable food markets and safeguarding supply chains

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Key Definitions

Waste management terms defined in Philippines legislation in 2000

This is a sample of a longer list of terms defined in the *Ecological Solid Waste Management Act 2000, also referred to as RA 9003. The terms included in this sample are selected for relevance to the Resilient Cities waste management report.*

Collection: the act of removing solid waste from the source or from a communal storage point

Composting: the controlled decomposition of organic matter by micro-organisms, mainly bacteria and fungi, into a humus-like product

Controlled dump: a disposal site at which solid waste is deposited in accordance with the minimum prescribed standards of site operation

Disposal: the discharge, deposit, dumping, spilling, leaking or placing of any solid waste into or in any land

Ecological solid waste management: the systematic administration of activities which provide for segregation at source, segregated transportation, storage, transfer, processing, treatment, and disposal of solid waste and all other waste management activities which do not harm the environment

Materials recovery facility: a solid waste transfer station or sorting station, drop-off center, a composting facility, and a recycling facility

Municipal waste: wastes produced from activities within local government units which include a combination of domestic, commercial, institutional and industrial wastes and street litters

Recovered material: material and by-products that have been recovered or diverted from solid waste for the purpose of being collected, processed and used as a raw material in the manufacture of a recycled product

Resource recovery: the collection, extraction or recovery of recyclable materials from the waste stream for the purpose of recycling, generating energy or producing a product suitable for beneficial use provided that such resource recovery facilities exclude incineration

Sanitary landfill: a waste disposal site designed, constructed, operated, and maintained in a manner that exerts engineering control over significant potential environmental impacts arising from the development and operation of the facility

Segregation: a solid waste management practice of separating different materials found in solid waste in order to promote recycling and re-use of resources and to reduce the volume of waste for collection and disposal

Solid waste: all discarded household, commercial waste, non-hazardous institutional and industrial waste, street sweepings, construction debris, agricultural waste, and other non-hazardous/non-toxic solid waste

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Solid waste management: the discipline associated with the control of generation, storage, collection, transfer and transport, processing, and disposal of solid wastes in a manner that is in accord with the best principles of public health, economics, engineering, conservation, aesthetics, and other environmental considerations, and that is also responsive to public attitudes

Solid waste management facility: any resource recovery system or component thereof; any system, program, or facility for resource conservation; any facility for the collection, source separation, storage, transportation, transfer, processing, treatment, or disposal of solid waste

Source reduction: the reduction of solid waste before it enters the solid waste stream by methods such as product design, materials substitution, materials re-use and packaging restrictions

Source separation: the sorting of solid waste into some or all of its component parts at the point of generation

Waste diversion: activities which reduce or eliminate the amount of solid waste from waste disposal facilities (specifically, landfills)

Market terms defined in the Quezon City Revised Market Code

This is a sample of terms defined in Ord. No. SP-2459, S-2015. Some definitions are described in greater detail in the ordinance but are shortened in this report for concision.

Public Market: any structure, building, or place of any kind which has been established, designated, or authorized by the City Council, whether government or privately-owned and operated, dedicated to the service of the general public, where wet and dry products may be bought and sold. It includes the following, but excludes hypermarts, minimarts, groceries, and establishments of similar nature:

> **City Market**: government-owned and/or operated public markets established out of public funds or those leased/acquired by any legal modes or means from persons, natural or juridical, to be operated by the City Government or through its instrumentality, branch, or political subdivision
>
> **Private Market**: public markets established by an individual or group of individuals out of private funds and operated by a private entity, natural and juridical, under government franchise and permit
>
> **Talipapa / Satellite Market**: type of public market with less than 50 stalls and minimum required facilities and usually caters to a limited number of customers found in a small community

Sections of public markets delineated by the ordinance include:

- Meat, pork, and dressed chicken section
- Fish section
- Dry goods section
- Vegetable and fruit section
- Poultry products section

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- Plants and garden section
- Groceries/sari-sari section
- Eatery section
- Miscellaneous and other special services section

Ambulant, transient, or itinerant vendor: a vendor who does not occupy a definite place or stall in the public market but who comes either daily or occasionally to sell his/her goods within the market premises

Hawker/peddler: an ambulant or mobile vendor who sells his goods outside the premises of a public market, usually on sidewalks, streets, thoroughfares, government lot and other public spaces

Street Vendor: a vendor who offers goods or services for sale on streets, sidewalks, and other public areas; may be stationary or mobile, and includes hawkers, peddlers, or sidewalk vendors

Additional Definitions

Trader: an actor who transports market goods (produce, meat, fish) between or within levels in the food market chain (eg. trading center to wholesale market, wholesale market to retail market, retail market to retail market, etc.).

Vendor: a broad term to describe an actor in the food value chain involved in selling goods (produce, meat, fish, dry goods, etc). Vendors usually sell from a stall, cart, or other contraption to display goods.

Informal Worker: a lengthy definition is described by the International Labor Organization. In this paper, informal workers in the food market context typically have the characteristics (but are not limited to): lack of written contracts, not registered with city hall, do not pay necessary fees for vending sites

Biodegradable Waste: used interchangeably with organic waste to describe a type of waste that typically originates from plant or animal sources and is capable of being decomposed

Special Waste: waste that cannot be collected by regular collection trucks due to size, weight, chemical properties, etc. Examples include large furniture or lab materials.

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Introduction

The Importance of Waste Management

The Philippines generates approximately 22.3 million tons of waste a year (EMB, 2018). By 2025, this value is expected to rise to 23.6 million tons per year, exacerbating the many challenges associated with waste management (EMB, 2018). The UNDP (2021) attributes waste issues to “poor waste management infrastructure, lack of materials recovery facilities, and lack of discipline of people”. This results in significant environmental damage and implications for human health.

Environmental concerns are especially pressing in terms of oceanic plastic pollution as the Philippines releases an estimated annual discharge of 1.9 million metric tons of plastics into the ocean (Tetra Tech, 2020). These authors also note that an island topography and high annual rainfall add to the likelihood of plastics entering the ocean (Tetra Tech, 2020). Overall, this places the Philippines as a country with the highest probability (7%) of “mismanaged plastic waste entering the ocean by country” (UNDP, 2021). The Covid-19 pandemic adds another layer of complexity to the waste challenge as face masks and medical supplies contribute to the growing generation of waste (Tetra Tech, 2020). In addition, organic and biodegradable wastes, which account for a much larger 52.31% of municipal waste in the Philippines, are linked to environmental concerns such as methane, black carbon emissions, and leachate collectively pollute the ground, water, and air. These consequences are also linked with health risk, as these pollutants enter bodies through inhalation or drinking water. Organic wastes are also higher in moisture content, which require more fuel to transport and shorten the lifespan of landfills (EPA Office of Resource Conservation and Recovery, 2020).

During heavy rainfall events, what may normally be hidden or underlying issues in waste are made explicit. Especially in urban areas, excessive waste clogs drainage infrastructure and worsens flood risk (Jerry Garcia, personal communication). The direct consequences of poor waste management to Filipino households made news headlines in 2006 when a garbage landslide in Payatas dump buried hundreds of homes (ADB, 2004). Media scrutiny urged the government to improve waste management and ensure the safety of landfills and dumpsites.

The Ecological Solid Waste Management Act of 2000: a summary

The Ecological Solid Waste Management Act 2000, also referred to as RA 9003, was implemented in 2000 to address the growing waste issues in the Philippines. The act consists of a series of guidelines and regulations which cover the collection, disposal, diversion, and recovery of waste across the Philippines. Highlights of the act include the requirement to segregate waste (or no collection), the promotion of materials recovery facilities (MRFs) in barangays, and the disposal of waste in sanitary landfills (as opposed to open dumpsites) (Congress of the Philippines, 2001). The act urges LGUs to reach a 100% collection efficiency and 25% diversion from waste disposal facilities. Suggested strategies to divert waste include re-use, recycling, and composting. The MMDA has further specified a target to conduct 240 annual waste management seminars and ensure that 100% of Metro

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Manila LGUs have access to a sanitary landfill for the next 10 years (MMDA Corporate Planning and Management Staff, 2021).

Compliance towards the Solid Waste Management Act is under the responsibility of Local Government Units (LGUs), which, in Metro Manila, form 17 municipal SWM boards and 1509 barangay SWM committees (Senate Economic Planning Office, 2017). RA 9003 requires each LGU to submit a 10-year solid waste management plan to the Environmental Management Bureau (EMB, 2018) of the Philippines. This 10-year plan should include a Waste Analysis and Characterization Survey (WACS) report that quantifies and describes current waste generation in the LGU. In the Philippines, 69.41% of the LGUs have approved 10-year plans, 26.81% are under approval, and only 3.79% have not yet submitted a 10-year plan (Annex A, EMB, n.d.). In Metro Manila, all the LGUs have submitted and had their SWM plans approved. Still, statistics from 2017 reveal that only 50.73% of waste is segregated at source and 44% have separated collection (EMB, 2018). While RA 9003 set the scene for improvement in national waste management, even 22 years after its establishment, there are still significant waste challenges and insufficient compliance to the act (Commission on Audit, 2002).

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Methods

This report will target waste management specifically at food markets for WP2 of the Resilient Cities initiative of CGIAR. While there is limited data specific to waste at the market-level, observations in various Metro Manila markets and interviews with market administration offices, vendors, and waste collectors provide insight for this waste management report. From a rapid diagnostic of food vendors in Metro Manila, Quezon City and Pasay City were identified as focus cities for the Resilient Cities project as they offer manageable opportunity in comparability for lessons and improvements. This report will therefore scope the opportunities and challenges in waste management in these two cities to build a better foundation of knowledge to design vendor business schools.

Data collection for this report is primarily from observation and interviews with actors in Quezon and Pasay City. A list of all interviewed persons is detailed in Annex B. Insight for the market waste in Kamuning Market are formed primarily from interviews with the Quezon City Market Development and Administration Division and the Kamuning Market Administration Office, as well as observations and records of Kamuning market and its composting activity. For insights in the Pasay City section of this report, key interviews are from the Pasay Public Market administration office and the Pasay City Environment and Natural Resources Office (ENRO). It was more challenging to obtain market records for Pasay Public Market, so statistics from Pasay City's 10-year-solid waste management plan are used for data analysis. However, because this report was published in 2014, the statistics risk being outdated.

Although limited, these data sources aim to introduce the current state of waste management at Quezon and Pasay City with an emphasis on market-level waste. The combination of sources work to characterize challenges and opportunities within market waste management to contribute to WP2 of the Resilient Cities project.

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Waste Management in Metro Manila

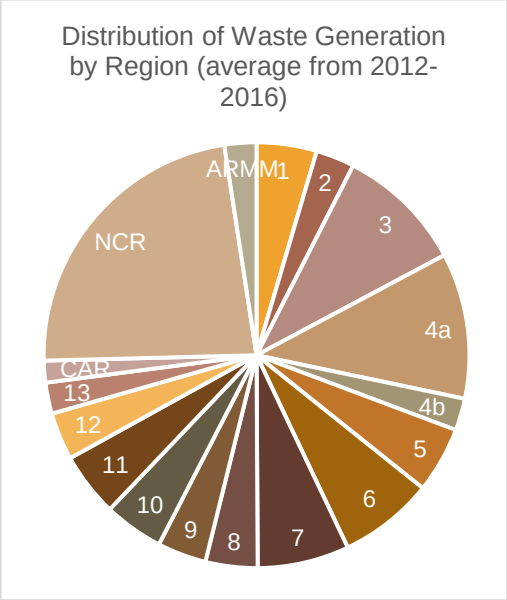

Figure 1. Distribution of waste generation by region in the Philippines (2012-2016). Data from EMB (n.d.)

The Environmental Management Bureau of the Philippines (EMB) estimates that as of 2022, Metro Manila generates approximately 3,589,451 tons of waste per year. Expectedly, this is the greatest waste generation by region in the Philippines (Figure 1), contributing to 23% of the national waste generation in 2016 (Senate Economic Planning Office, 2017). Tetra Tech (2021) suggests that a major component to this statistic is the rapid economic growth and urbanization in Metro Manila. Between the different LGUs in Metro Manila, Parañaque City has the highest waste generation per capita at 1kg/day and Taguig City has the lowest per capita waste generation at 0.27kg/day (Figure 2). Overall, the average per capita waste generation in Metro Manila LGUs is 0.61kg/day (EMB, n.d.). Sources of waste are categorized by the Philippine government as residential, commercial, institutional, and industrial, where in 2013, residential waste accounted for 57% of waste generation in Metro Manila (Senate Economic Planning Office, 2017). Market waste is part of the commercial waste category, contributing to 18% of the total waste generation in the Philippines (Tetra Tech, 2020). Interestingly, most of the waste from Metro Manila is

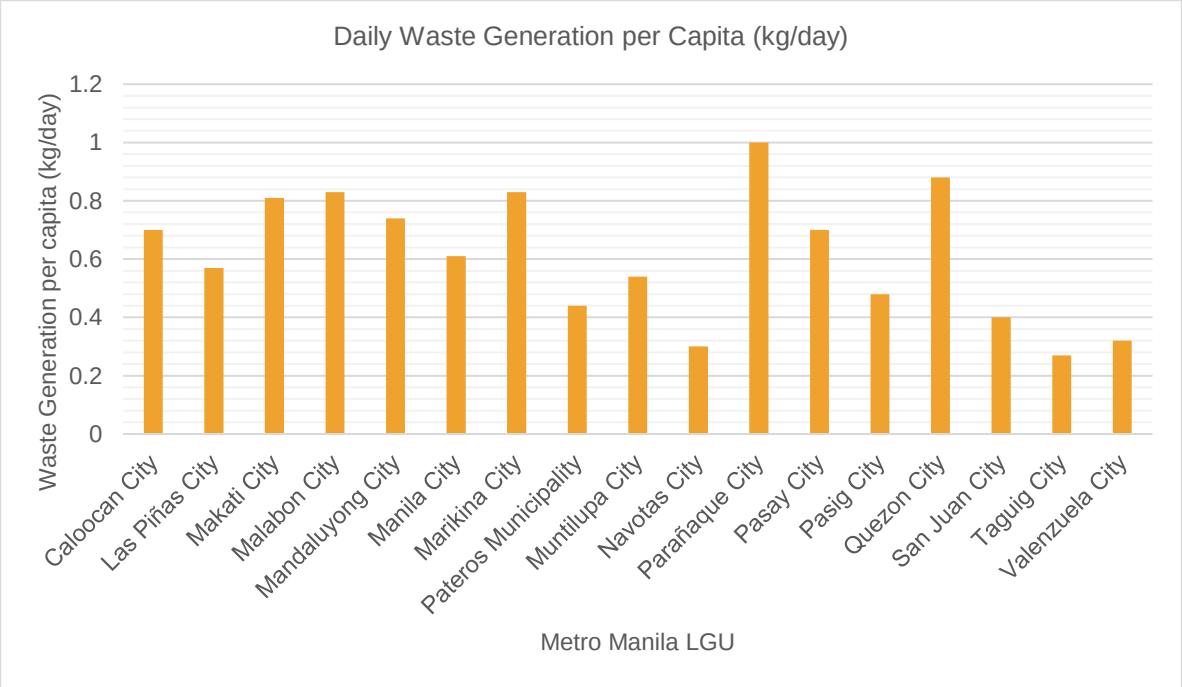

Figure 2. Daily waste generation per capita in Metro Manila (2022) Data from EMB (n.d.)

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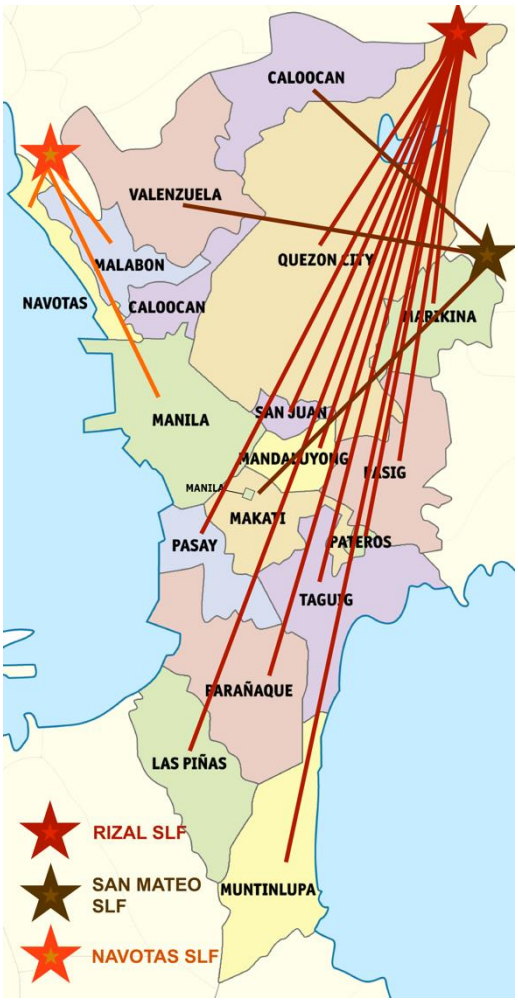

Figure 3. Waste distribution in Metro Manila by provider (2022). Data from EMB (n.d.) and basemap from Adkranz (2014)

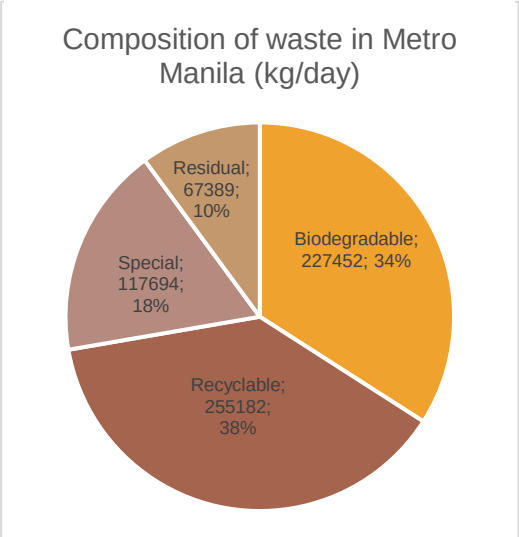

Figure 4. Daily waste composition in Metro Manila. Data from: EMB (n.d.)

biodegradable or recyclable, suggesting the substantial opportunities in waste diversion through materials recovery, composting, and recycling initiatives. For specific data on the waste composition in Metro Manila by LGU, refer to Annex C.

Statistics from the Senate Economic Planning Office (2017) indicate that 85% of the total waste generated is collected in Metro Manila. Although it is not explicitly stated, the remainder of this waste is expected to represent waste that is discarded in public spaces, such as roadsides, vacant lots, or open waterways. 53.82% of the waste generated in Metro Manila is disposed in three major landfills: Rizal Provincial SLF, Navotas SLF, and New San Mateo SLF (EMB, 2018). These sanitary landfills are subject to a comprehensive list of regulations by RA 9003 and promoted over open dumping or conventional landfills. Of these landfills, the Rizal Sanitary Landfill, owned and operated by private company International Solid Waste Integrated Management Specialist Inc, or ISWIMS Inc, is the most popular waste disposal site for Metro Manila LGUs (Figure 3). Other waste collection providers in Metro Manila include LEG Hauling Services Corporation, IPM, Leonel Waste Corporation, Phileco, Dominus, Atlas, Steriplus, and Metrowaste Solid Waste Management Corporation. The EMB keeps records of which landfills are used by different LGUs, which is mapped in figure 3 to illustrate waste flow in Metro Manila. It should be noted, however, that these records are limited to the official waste management partners of LGUs and do not necessarily include waste providers contracted with the private sector. Still, waste evidently travels long distances across already congested streets of Metro Manila to reach SLFs to the north of Metro Manila. To shorten these travel distances, there is urgent need for an SLF to the south of Metro Manila.

Figure 4 shows the composition of waste in Metro Manila, emphasizing the significant proportions of recyclable (38%) and biodegradable (34%) waste. It is important to acknowledge that these

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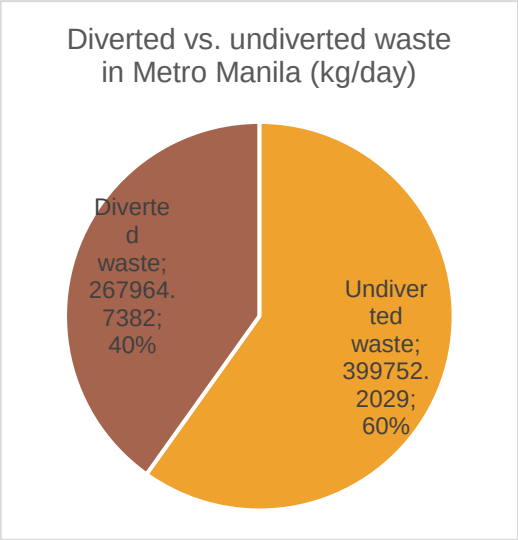

Figure 5. Diverted vs. undiverted waste in Metro Manila. Data from EMB (n.d.)

figures represent all sources of waste. When specifically analyzing municipal waste, the proportion of biodegradable waste is much higher. Impressively, 58% of the barangays in Metro Manila are equipped, although not necessarily operating, MRFs (EMB, 2020). This results in a waste diversion of approximately 40% (Figure 5)

Waste Generation in Food Markets

Food markets in Metro Manila consist of, but are not limited to, privately-run, municipal-run, and local barangay authorized, vendor run *talipapa* markets. They contribute to 18.3% of Metro Manila's total waste generation and are composed of predominantly biodegradable wastes (UNDP, 2021). The specific composition and volume of waste varies by market and by day as factors such as the products sold, weather, seasons, or holidays influence generation. When there is a typhoon, for example, perishable crops are more prone to spoilage, and this may translate to greater market waste generation. However, overall production of food waste is minimal as vendors practice a "business-oriented" mindset, according to one Quezon City MDAD official. Vendors will sell any marketable part of their food, describing any wasted produce as wasted profit. Observations in various Metro Manila markets (Commonwealth, Mega-Q Mart, Pasay Public Market, Kamuning Market, and Divisoria), support this description: even food scraps were sold as animal feed. Organic waste that was commonly observed in Metro Manila food markets are food *scraps (such as vegetable leaves/tops, fish scales, or animal bones),* as opposed to whole foods or meats. According to the MDAD officials, this is largely because farmers align their production with market demand to avoid over production. For a detailed description of waste observations in these markets, refer to Annex D. In general, most of the waste produced at these markets were plastics and spoiled, no longer marketable foods.

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Waste Management in Quezon City

Quezon City is the largest city in Metro Manila by size and population. As of 2014, Quezon City generates approximately 2,715 tons of waste per day, with 0.88/kgs/person/day (Rentoy, 2014). The city is also the second largest generator of waste per capita within Metro Manila. Still, Quezon City is recognized as a pioneer in waste management in the Philippines for their early implementation of RA 9003 (Quezon City Environmental Management Program, 2021). The city also recently launched a zero-waste initiative which includes the operation of a rapid composting machine, trash to cash system, and pulverizing non-biodegradable waste to form bricks (QC MDAD, 2022). As of October 2022, the initiative is still in its first phase, which operates a rapid composting machine in the pilot site of Kamuning Market.

Table 1. Quezon City Waste Composition.

Type of Waste	Percentage
Biodegradable	53.95%
Recyclable	20.30%
Plastic	9.64%
Paper	8.65%
Glass/Bottle	1.15%
Metals	0.86%
Residual	25.76%

Data from Rentoy (2014)

Quezon City employs ISWIMS, Dominus, Steriplus, and Atlas as waste collection providers, all of which dispose waste in the Rodriguez, Rizal sanitary landfill (Annex E). The source of this waste is mostly residential; however, retailers and contractors also contribute significantly to waste generation (Annex F). Furthermore, the composition of the city's waste is mostly biodegradable, followed by residual and recyclable waste (Table 1).

Administrative Organization of Food Markets in Quezon City

Public markets in Quezon City are monitored and regulated by the Quezon City Market Development and Administration Department (MDAD). This department defines public markets as food markets that are open to the public, including private-owned, city-owned, and *talipapa* markets. Monitoring activities include price checking and adherence to market regulations (such as maintenance of stalls, proper permits). Within Quezon City, there are 27 private-owned and 8 city-owned public markets. The number of *talipapa* markets is estimated around 50+, but a definite number is unknown. The Quezon City MDAD has the greatest control over city-owned public markets. In these markets, officers from the city government are physically present in the market administration office. The city oversees administration items such as the rental of vending stalls, cleaning schedules of the market, and waste collection. In private-owned markets, this is organized by the private owners, so the city has less oversight on these processes. Talipapa markets are also difficult to oversee because of their diversity and numbers. Still, inspectors from the MDAD are formally required to visit private-owned markets once a month and talipapa markets once every three months to check in on market activity and compliance to city-level regulations. To what extent this requirement is carried out, however, undetermined.

Vendors at markets, whether this is city-owned, private-owned, or talipapa, are required to segregate their waste for it to be collected. The Ecological Solid Waste Management Act RA 9003 requires separating recyclable, compostable, and residual wastes. Waste haulers are trained to identify if the waste they collect are properly segregated; however, it cannot be expected that every bag of waste is checked for proper segregation. Different colored bags

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are used to distinguish the types of waste and are hauled into waste collection trucks for transportation to their respective waste facilities.

The Quezon City MDAD shares that trucks which collect waste for city-owned public markets in cost 12,000PHP per truck. Minimizing the waste which ends up on these trucks is beneficial not only for environmental reasons, but also to minimize costs of hauling and transportation.

Market Regulations for Waste Management

To conduct vending activities in Quezon City, vendors need to first pass sanitation requirements. Only after formally meeting these requirements can potential vendors apply for market permits. In theory, *all* vendors need to obtain a market permit to legally vend foodstuffs; however, the Quezon City MDAD estimates that for every 1 legal food vendor, there are 2 'illegal' vendors. Despite acknowledging the scale of unregulated vendors, the market administration lacks the personnel to regulate all the vendors in Quezon City. Street hawkers are specifically considered by Quezon City MDAD officials as the most challenging group to monitor because of their diversity and numbers. However, the market administration is working on implementing more regulations to lower this ratio of legal to illegal vendors. To address these challenges as well as the broader issues of waste management and food vending, Quezon City also established a task force for food security and solid waste management.

A revised market code for Quezon City was published in 2015, which includes a series of regulations that apply to various food markets in the city. Since the implementation of RA 9003, waste management systems needed to incorporate waste reduction, segregation, and recycling initiatives. As outlined in the 2015 revised market code, "public market management shall provide for proper garbage collection, storage, and disposal, while market smallholders shall practice segregation and provide their own garbage bags or receptacles". The distribution of plastic bags in public markets is also prohibited. Only plastic bags with "no handles, holes, or strings" are allowed for packaging wet goods such as "pork, beef, chicken, fish, and other seafood and marine products, fruits, vegetables, cooked food and uncooked rice". On top of this market code, vendors and hawkers must also comply with sanitation codes. However, although the market administration values the cleanliness of markets, regulations tend to focus on price monitoring and the requirement of white lights.

Street hawkers also face regulations specific to their type of vending activity. For example, street hawkers are allowed move around the city, but the nature of their vending activity cannot be mobile. In other words, the actual sales from these vendors must be conducted while vendors are stationary in what the market administration terms "temporary vending sites". While this restriction aims to ease the challenges in monitoring street hawkers, limiting mobility may also restrict the hawkers' businesses and the access poorly nourished consumers may have to food sources. When these regulations are not met, the market administration gives vendors a notice. After three notices, vending areas may be removed, cutting boards may be confiscated, or permits may be revoked.

The market administration has difficulties ensuring and monitoring vendors' compliance with regulations. While the Quezon City MDAD describes resistance from vendors in adjusting to

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new regulations, vendors also experience harassment and abuse from local authority officials and the police. More detailed perspectives from market vendors are described in the later section *Perspectives in Food Market Waste Management*.

Waste Management in Kamuning Market

Waste at Kamuning market is segregated into biodegradable, non-biodegradable, and recyclable waste. Vendors are responsible for segregating the waste at their vending stalls and collecting waste in color-coded trash bags. Staff from Excellence, a private waste collection service employed for Kamuning Market, collect these bags directly from market stalls. These bags are brought to the market waste collection site, where they are hauled onto large garbage trucks. Previously, Kamuning Market needed to hire two trucks to collect the waste produced at the market. However, since the operation of the composting machine, the Quezon City MDAD shares that the market waste is hauled in just one truck a day.

The composting machine (formally, a rapid composter) in Kamuning Market processes vegetable scraps, fish scraps, charcoal, and sawdust to create soil conditioner. The entire process to turn the organic inputs into soil conditioner includes manual mixing, processing in the composting machine, air-drying, and packaging in polypropylene bags. The composting machine typically runs for an hour both in the morning and afternoon, and the drying process takes approximately 3 days (with variation depending on weather conditions). For a detailed description of each step in the composting process, see Annex G. Currently, compost inputs from the market are limited to vegetable and fish scraps because of technical specifications of the composting machine. The Quezon City MDAD describes that other machines that process wastes such as animal parts or grain also exist, but the vegetable/fish waste composting machine was most suitable for Kamuning Market (because these are the largest components of market waste). Furthermore, because the supply of charcoal currently relies on consolidated inputs from several markets in Quezon City, this charcoal input may limit the operation multiple composting machines. The volume of inputs supplied to the Kamuning Market composting machine are recorded daily and submitted every Monday to the Quezon City MDAD (Table 2).

Table 2. Composition of Kamuning Market Waste

Date	Type of Garbage (in kg)									
	Non-Biodegradable			Biodegradable					Others	
	Plastic (Bags/ Bottle)	Textile waste (tela)	Pork Bones	Fruits/Veg	Fish Gills/ Scales	Woods/ Crates	Chicken Feathers	Buko/ Coconut Shell	Charcoal (Uling)	Sawdust (Kusot)
6/9/22	87.5	90.5	3.5	126.0	25.0		54.0		10.0	5.0
7/9/22	105.0	84.0	57.0	185.0	45.0		11.0		18.5	18.0
8/9/22	99.5	61.5	14.0	200.0	40.0		61.5		15.0	15.0

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9/9/22	65.5	63.5	36.0	170.5	42.5	34.0	13.0	13.0
10/9/22	79.0	48.5	55.0	174.0	38.0	41.0	20.0	
11/9/22	86.5	46.5	60.0	163.0	29.0	1.0	10.0	
12/9/22	92.5	57.0	31.5	208.5	15.0	15.0	6.0	7.0
WEEKLY TOTAL	615.5	451.5	257	1227.0	234.5	217.5	92.5	58.0

Digitalized from a sample of records shared by the Kamuning Market Administration

Compost workers at Kamuning Market elaborated that the composting operation had an input capacity of 100kg (for a total capacity of 200kg daily because the machine runs twice a day). This was described as the capacity of the receptacle in which the compost inputs were manually mixed before being fed to the machine. This receptacle is a rectangular border on the ground, so exceeding this "capacity" seems possible by piling more material vertically. The machine itself does not have a strict capacity because inputs are fed in a staggered manner. If there were more inputs, this would only result in greater time needed to process all the material. Furthermore, the records from the Kamuning market office indicate that the sum of vegetable and fish waste collected occasionally exceed 200kg. It is unclear if in this scenario the excess waste is excluded from composting activity or if workers fit the extra waste into the receptacle. Therefore, the following calculations on market waste at Kamuning are operated both under the assumption that 1. all vegetable and fish inputs are fed to the compost machine, and 2. A maximum of 200kg of vegetable and fish inputs are fed to the machine. The percentage of waste diversion and financial savings from diversion are calculated to provide insight on the impacts of the composting machine on the overall challenge of waste in the landfills. It should be acknowledged, however, that these calculations are based off a series of assumptions and are only intended to provide a broad idea of potential impacts. More robust and accurate figures are expected from government reports on waste management (which are elaborated in the section recommendations for future data collection).

Data Processing Protocol

- Values from week 6/9/2022 – 12/9/2022 are used as a proxy for waste generation in Kamuning Market. From the sample of records received from the Kamuning Market administration, this week was the most complete (of a sample of only two weeks)
- The category "fruit/veg" is used to represent vegetable inputs for composting. Because the ratio of fruits to vegetables wastes is unknown, this category is simplified as fully vegetable waste for the purpose of further data processing
- The values of charcoal and sawdust collected vary from week to week. It is assumed that all of the collected charcoal and sawdust is used in composting activity

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Data Processing Results

ASSUMPTION: 200kg compost input capacity

Table 3. Waste diversion at Kamuning Market assuming 200g compost input capacity

Date	Total Waste (kg)	Compost-able Waste (kg)	Composted (%)	Diversion by Composting (%)	Plastic Waste (bottles and bags (kg)	Total Diversion (kg)	Total Diversion (%)
6/9/22	402	166.0	100%	41%	87.5	253.5	63%
7/9/22	524	266.5	75%	38%	105.0	305.0	58%
8/9/22	507	270.0	74%	39%	99.5	299.5	59%
9/9/22	438	239.0	84%	46%	65.5	265.5	61%
10/9/22	456	232.0	86%	44%	79.0	279.0	61%
11/9/22	396	202.0	99%	51%	86.5	286.5	72%
12/9/22	433	236.5	85%	46%	92.5	292.5	68%
TOTAL	3154	1612.0	87%	44%	615.5	1981.5	63%

When the composting machine runs at its 200kg daily capacity, the weekly waste diversion is approximately 44% (Table 3). Because of this significant reduction in waste output of Kamuning Market, the trucks needed for market waste collection is reduced from 2 trucks/day to 1 truck/day according to MDAD officials.. As a result, transportation costs are also reduced by 50%, equivalent to PHP360,000 of savings on truck costs in a month. Furthermore, if the collected plastic wastes are also recycled, waste diversion can reach 63% (Table 3), surpassing the goal outlined by RA 9003 of 25% waste diversion. This figure, however, assumes that all the collected plastics are suitable for recycling. Common recycling facilities typically only recycle types #1 and #2 plastics (Bennet & Alexandridis, 2021). Because the records from Kamuning Market combine waste from plastic bottles and bags, it is difficult to distinguish the amount of *recyclable* plastic waste, or why these two types of waste are combined. From observation, a large portion of the plastic waste in Kamuning Market were plastic bags, which are made of #4 plastic and difficult to recycle.

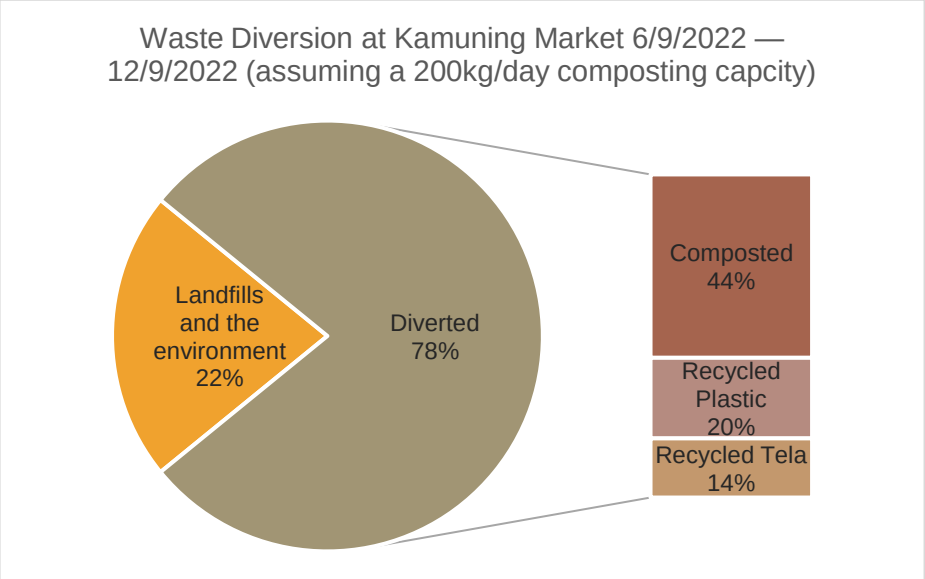

Figure 6. Waste diversion at kamuning Market assuming a 200kg compost capacity

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Aside from diverting plastics and organic waste, the Kamuning Market administration also shares plans to divert *tela*, or textile, waste. Kamuning Market is a prominent hub for the textiles industry and generates roughly 400kg of textile waste a week. Although textiles is not yet harnessed in waste diversion initiatives, if this waste were also included in diversion, the total market diversion could reach up to 78% (Figure 6).

78% and 63% waste diversion for scenarios with and without textiles (*tela)* recycling are impressive figures for waste management at Kamuning Market. Although these are expected to over-estimate the reality of diversion, well over half of the waste sent to landfills (and the environment) has been reduced. In addition, to exemplify the potential waste diversion if all possible compost inputs were processed by the composting machine, there would be an approximate 51% diversion by composting, raising the total diversion to 85%, or 2679kg (Annex H).

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Waste Management in Pasay City

In 2020, Pasay City generated approximately 370,370kg of waste per day (**source**). Compared to other cities in Metro Manila, the per capita waste generation in Pasay City is the 10th largest at 0.7kg/person/day (EMB, n.d.). A Waste Analysis and Characterization Survey (WACS) report from 2014 further indicates that residential waste is the largest contributor to the city's waste output, followed by commercial and institutional waste. The waste generation *rates* identified in the report, however, reveal that individual restaurants and market stalls are significant contributors to the city's waste generation with rates of 4.080 and 3.594kg/day (table 6). This highlights the opportunities for intervention in restaurants and markets to reduce the city's waste generation.

Table 4. Waste generation in Pasay City

Category of Waste	Generation Source	Unit	WGR	Quantity	Total Average Waste Amount Per Day (kg)
Residential	Households	kg/person/day	0.569	460,274	262,035.83
Commercial	Restaurants	kg/restaurant/day	4.080	1,802	7,352.16
	Other Shops	kg/shop/day	1.759	10,816	19,025.34
Institutional	Offices	kg/employee/day	0.033	41,551	1,371.18
	Schools	kg/person/day	0.002	67,998	136.00
Industrial	Industries	kg/industry/day	2.432	70	170.24
Market	Stalls	kg/stall/day	3.594	2,555	9,182.67

Values from the Pasay City 10-Year Solid Waste Management Plan

Administration and regulation in solid waste management

Pasay city consists of 201 barangays which are divided into 8 "barangay zones" for responsibilities in solid waste management. The city has a 10-year solid waste management plan that was approved in 2015. Barangays in Pasay City are additionally required to supplement this 10-year plan with localized 5-year plans. Certificates from the Pasay City ENRO are presented to LGUs which successfully publish and follow through with these plans. Furthermore, a city-wide Waste Analysis and Characteristics Survey (WACS) is conducted to inform and guide initiatives in the 10-year and 5-year plans. This survey is supposed to occur every three years. However, the Pasay City ENRO admits there has not been a WACS report submitted since 2014. Restrictions from the pandemic further delayed the realization of this survey in 2020. In order to maintain compliance with the city's 10-year plan, the Pasay City CENRO describes the urgent need for an updated WACS report.

Waste in Pasay City is divided into biodegradable, non-biodegradable, and special wastes such as hazardous or bulky waste. A specific waste collection schedule is designed to collect these different categories of waste and applies to all of the barangays in the city (Table 5**)**. Waste collectors employed by the city are trained to enforce a "no segregation, no collection" policy to improve waste management. Furthermore, the ENRO describes that since the

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implementation of this policy, segregation practices in barangays across the city have improved.

Table 5. Schedule of waste collection in Pasay City

Monday	Biodegradables
Tuesday	Non-biodegradables
Wednesday	Biodegradables
Thursday	Non-biodegradables
Friday	Biodegradables
Saturday	Non-biodegradables
Sunday	Special waste (hazardous, bulky, or otherwise difficult to collect)

Data from an interview with the Pasay ENRO

Pasay City's ENRO describes that ideally, only 20% of the municipal waste generated is sent to the landfills. To encourage and educate the public on waste segregation, voluntary trainings are provided by the Information, Communication, and Education Office (ICE). These trainings are encouraged for both public and private businesses but are not required in obtaining a vending license. As a result, participation in these trainings is not as active, and most outreach is through passive forms such as the distribution of fliers on waste segregation.

Waste Management in Pasay Public Market

In contrast to Quezon City, Pasay City has only one city-owned public market, Pasay Public Market. The market is under the jurisdiction of barangay 91/92, led by Mr. Adrian Ferrer. Waste at the market is collected daily by the private contractor ISWIMS, where it is transported to the Rodriguez Sanitary Landfill. Pasay Public Market typically requires 3-4 trucks daily to collect all market waste. When the market administration observes a greater volume of waste, extra trucks are hired. As a result, the Pasay City ENRO describes that uncollected or excessive accumulation of waste is not an issue at Pasay Public Market. The main waste collection challenges at the public market are in terms of special waste. Market vendors, especially in the meat section, typically use large slabs of tree trunks as cutting boards. Due to their size, these boards cannot be collected as regular waste and need to be collected as "special waste". Discarded cutting boards especially pile up during disciplinary action by the market administration. Because these boards are relatively expensive assets for market vendors, they are confiscated by the market administration as a penalty for non-compliance to market regulations. However, during these crack-down periods, many cutting boards may accumulate, and special mini-trucks need to be hired to properly dispose of the boards.

The 2014 WACS report in the Pasay City 10-year solid waste management plan includes an analysis of waste composition for different waste sources (Table 6). Surprisingly, markets in Pasay City generate almost as much plastic as kitchen wastes. Compared to the average composition of waste from industries, commercial stores, restaurants, institutional offices, and institutional schools, the waste generated at the public market is remarkably similar.

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These values are taken directly from table 4-11 in the Pasay City 10-year solid waste management plan. When calculations for average values are manually checked, however, errors were found. Where correct means are different by greater than 0.5%, the value is marked in red. The column/row of corrected means are indicated with an asterisk.

Table 6. Composition of non-household waste in Pasay City by source

Category	Commercial Other Shop (%)	Restaurant (%)	Institutional Offices (%)	Institutional Schools (%)	Industries (%)	Market (%)	Average (%)	Average* (%)
Paper	22.80	9.21	35.52	22.65	24.74	15.81	21.79	21.79
Glass	4.57	4.95	3.00	0.00	0.00	2.28	2.28	2.47
Metal	2.28	1.88	2.37	1.03	0.60	1.40	1.40	1.59
Plastic	24.59	16.55	27.46	22.98	24.38	22.40	22.40	23.06
Kitchen Waste	35.75	55.09	17.80	22.14	33.63	36.67	36.67	33.51
Other Organic	0.21	0.00	0.14	0.02	5.66	1.01	1.01	1.17
Other Inorganic	2.13	0.06	1.52	1.55	0.85	1.60	1.60	1.29
Hazardous	0.14	0.27	0.00	0.04	2.08	0.48	0.48	0.50
Special	1.42	9.17	7.05	1.82	0.19	3.44	3.44	3.85
Yard Waste / Wood	0.60	0.97	2.67	22.23	2.44	4.91	4.91	5.64
Textiles	0.81	0.68	2.59	2.21	4.29	1.96	1.96	2.09
Rubber/ Leather	3.40	1.07	0.29	0.59	0.78	1.31	1.31	1.24
Others	1.31	0.11	0.00	2.74	0.35	0.75	0.75	0.88
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Total*	100.01	100.01	100.41	100.00	99.99	94.02	100.00	99.07

Data from the Pasay City 10-year SWM Plan

Ultimately, however, these results indicate that despite the diversity of waste types in Pasay City, total waste generated is dominated by the three categories, kitchen waste (33.51%), plastics (23.06%), and paper (21.79%). Because these types of wastes are also compostable or recyclable, there is significant potential for waste diversion and reducing the volume burden in landfills.

Across the city, 156 out of 201 barangays are equipped with materials recovery facilities (EMB, n.d.). These facilities have collectively recovered 47.39% of the city's waste, of which 30.55% is recyclable and 16.84% is compostable (Annex I). Furthermore, within the recyclable waste, the largest category is paper waste.

Pasay Public Market operates a compost machine which processes organic wastes collected from the market. The compost machine is much larger than that found in Kamuning Market in Quezon City and has also been in operation for a much longer time. For a detailed

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description of each step in the composting process at Pasay Public Market, refer to Annex J. In short, the compost machine in Pasay Public Market is a compost drum. Contrary to the quick processing in the rapid composting machine at Kamuning Market, the compost drum at Pasay Public Market runs for 24 hours a time. The composting process creates a soil conditioner which is distributed, free of charge, to parties which request the conditioner. Previously, the soil conditioner has been distributed to local schools to support school gardening projects. However, during the height of the covid-19 pandemic, the distribution of soil conditioner to these schools halted and has since been more irregular.

Unfortunately, records on the inputs collected and used in the compost machine were destroyed during a recent flood (although it is doubtful if these records existed beforehand). During the two visits to Pasay Public Market, however, it was noticeable that there were many cases where the composting machine was not in operation because what market officers described as limited inputs. Sawdust inputs that were supplied from a nearby toothpick factory were irregular and often insufficient to support the consistent operation of the composting machine. The composting activity is especially dependent on sawdust supply because of the volume of sawdust needed to operate the composting machine. Ratios of sawdust to vegetable scraps and fish gills are described in Annex K and focus around a 1:2 ratio (sawdust to market waste ratio). The compost worker at Pasay Public Market indicated that usually, the sawdust supply received from the toothpick factory would be completely used in three weeks. After the sawdust supply is depleted, the composting activity halts until a new shipment arrives. This suggests that even though the operation of the compost machine diverts waste from landfills, this potential diversion is not always achieved. During interviews with the Pasay City ENRO and Pasay Public Market Administration Office, there is limited indication of research or attention to the fluctuating operation of the composting machine. This highlights the importance of evaluations and monitoring of waste diversion technology.

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Perspectives in Food Market Waste Management

There are a variety of actors involved in waste management at the food market scale. These include, but are not limited to, waste collection workers, private waste hauling organizations, market vendors and hawkers, consumers, the market administration office, the environment and natural resources office, junkshop owners, scavengers, the police, market cleaners, waste processing workers, and garbage truck drivers. Due to limitations in time, only a sample of these actors were approached for this study. Their perspectives are briefly described below to supplement the Pasay and Quezon City case studies.

Waste collector at Commonwealth Market

Figure 7. Waste Collector at Commonwealth Market

Market waste in Commonwealth market is collected by both informal and formal workers (see Annex L for details on waste flow in Commonwealth market). A formal waste collector (Figure 7) employed by the waste management office of Commonwealth Market describes his waste management activities at the market. Currently, he is the only formal employee for waste collection at Commonwealth Market. He is responsible for making rounds to collect bags of waste which are consolidated in small piles throughout the market. He describes that these small piles are consolidated by informal waste workers who have agreements with vendors to collect waste from vending stalls. The formal worker manually compacts waste from the piles and brings them to the garbage truck collection point. In this way, the formal waste worker implies that informal waste collection helps his duties, although it is unclear if the formal and informal waste collectors explicitly work *together.* During these activities, the waste worker wore rubber boots but lacked gloves to protect his hands. The worker described that although he is advised to wear gloves, he preferred using his bare hands, arguing it helped him work faster and more efficiently. He also mentions that because there is a handwashing facility at the garbage truck collection point, he instead washes his hands after bringing each load of waste. So far, he has not incurred any serious injuries or infections while working bare-handed and is not too concerned about its potential risks.

During the visit, it is evident that the volume of waste generated and consolidated exceeds the capacity of a single waste collector. Furthermore, the piles of consolidated waste were numerous and spread throughout the market with no clear organization. Because of this distribution, many piles were yet to be collected and attracted rats to the market space. The waste collector further mentions that although he collects wastes throughout the market daily, the market itself is only cleaned once every 2-3 days. Although the waste worker did not know exactly, he believed these market cleaners are employed by the Commonwealth Market. He described that this cleaning typically consisted of “hosing down” the walkways between stalls with water. At the time of the interview, there had been no cleaning for 2 days.

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Market vendor at Divisoria Market

Hector is a cabbage vendor at Divisoria Market. He purchases cabbages wrapped in newspaper and packaged in 15kg plastic sacs from a trader every day. At his vending stall, he unwraps the cabbage, removes the outer peels, and stacks the cabbage in a pyramid for display. Hector mentions that removing the outer peel improves the visual appearance and marketability of cabbage — more customers are attracted to his stall when he displays blemish-free cabbages. He collects the discarded peels in a separate plastic bag which is then sold for animal feed at a lower price. He describes this as a coping strategy for managing the damage incurred by the cabbage in transport. In terms of waste management, this strategy utilizes food scraps which would otherwise become food waste. However, observations at the market revealed that many removed peels were neglected and found scattered throughout the market ground. This exemplifies that removing outer peels is both waste utilizing and waste generating.

Waste management administration officer for Divisoria Market

Ruben Lagarto is the head of waste and sanitation for Divisoria Market, barangay 1. The type of waste Lagarto most commonly sees is muddy water from vendors washing root crops. He argues that wholesale vendors generate the most waste at Divisoria Market because food losses are greatest at this level. He also mentions, however, that vendors argue traders are responsible for this waste, and it is only discarded at the vendor level because it is sold to them within the bulk of produce. Of the many types of food scraps generated at Divisoria market, Lagarto describes that ubod (coconut heart) is the most challenging in terms of waste management. Not only are the byproducts of ubod processing high in volume, but they also take a long time to decompose.

As part of his responsibilities, Lagarto oversees the work of street sweepers and waste collection trucks administered by the barangay. Street sweepers bring waste from vendor stalls to the garbage trucks, which come to Divisoria at approximately 4AM every morning. Lagarto describes that in addition to the formally employed street sweepers, there are many informal waste workers at Divisoria Market. However, from an administrative standpoint, he has limited knowledge of their management structure. Lugarto estimates that the informal and formal street sweepers together cover Divisoria market such that there is approximately 1 sweeper per block (between intersections of the streets).

Lagarto also describes the unique administration of Divisoria Market. He shares that the market is actually governed by six barangays (barangays #1-6, all zone one). This division complicates the delegation of responsibilities, especially in boundary areas between barangays. Lagarto expresses frustration with neighboring barangays especially when certain barangays fail to hire trucks to collect waste in their market sections. Lagarto describes that almost every week, he receives cleanliness complaints about other barangays and is forced to hire waste collection trucks himself.

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Market vendor at Kamuning Market

An anonymous vendor at Kamuning Market segregates waste at her vending stall. She has a wide plastic bin allocated for biodegradable wastes and a plastic bag pinned to the side of her stall which collects miscellaneous waste. When asked how she adjusted to segregating her waste, she does not suggest any strong feelings and only states that she does not have a choice in whether to segregate waste. She does mention, however, that she is pleased with the current waste management at the market because the workspace is a lot cleaner. Because her biodegradable waste is collected twice a day, she also has fewer problems with rats that make attempts to eat her produce. She contrasts this experience with how she felt under the previous waste collection provider. Under the previous provider, the vendors were responsible for cleaning the vicinity of their vending stalls. However, since Kamuning began contracting Excellence, workers from the provider cleaned the vending and walkway areas. Excellence staff also collect waste directly from her vending stall both in the morning and afternoon. She states that the market administration only contracted Excellence since the composting machine began its operation. She concludes that she is happy that the market administration is involved with the composting initiative for the environment, but also because of the direct benefits to her workspace.

Notes on different waste management perspectives

In just a few but nonetheless insightful and unique interviews with different actors, it is evident that there are diverse priorities surrounding waste management. Challenges that are described range from a lack of personnel, separate administrations with limited coordination, to poor perceptions of cleanliness, and improper compliance with segregation regulations (from the case studies in Quezon City and Pasay City). These perspectives also highlight the different activities that associated with waste generation, such as packaging with single-use paper and plastics or removing damaged/spoiled food parts. Overall, waste management is illustrated as a complex and interwoven issue of generation, administration, and mentality. These perspectives are critical pieces of insight in designing vendor business schools for the Resilient Cities initiative;

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Discussion and Conclusions

Sustainable waste management is undeniably important for both the environment and human health. Literature describes the impacts of poor waste management which range from plastic pollution in oceans to harmful emissions, to leachate generation, and to the destruction of homes and lives. In the Philippines, and especially Metro Manila, these challenges are particularly significant as local communities are progressively impacted by the operation of landfills that are quickly approaching their capacity (ADB, 2004). To address these issues and mitigate further consequences, the RA 9003 Ecological Solid Waste Management act was implemented in 2000. Under RA 9003, waste management is detailed as a collective system of collection, disposal, diversion, and recovery.

Food markets in Metro Manila present a unique opportunity for waste management because of their contribution to and composition of waste. Markets compose of approximately 18% of Metro Manila's municipal waste (UNDP, 2021). Furthermore, country-level statistics reveal that most of this waste is biodegradable. In 2015, an estimated 52% of the total waste generated in the Philippines was biodegradable (Senate Economic Planning Office, 2017**)**. As statistics from Kamuning and Pasay Public Market indicate, waste generation in food markets are predominantly organic and plastic wastes. Food markets, therefore, are a promising vector to simultaneously target a significant source and component of the country's waste challenges.

Composting facilities in two markets

Waste management interventions in Quezon City and Pasay City food markets currently focus on composting machines which divert biodegradable waste from landfills and process them into soil conditioners. In Quezon City, composting activity in Kamuning Market is estimated to divert approximately 44% of the market's total waste. In Pasay Public Market, market-level statistics are limited, but city-level statistics suggest that the 37% of organic waste from Pasay City markets could be potentially diverted by composting. While both composting machines produce soil conditioners as an end-product, their processing systems and administration differ (table 9).

Table 7. Comparisons of Kamuning and Pasay Composting Systems

	Kamuning Market	Pasay Public Market
Composting Machine	Rapid Composter	Compost Drum
Inputs	Vegetable waste, fish scales, sawdust, charcoal	Vegetable waste, fish scales, sawdust
Operation	1 hour of operation, 2 times a day	24 hours of operation
Other processes	Soil conditioner dries for 3 days	Soil conditioner dries for 5 months*
Outputs	Soil conditioner for Joy of Urban Farming	Soil conditioner with no regular demand, but previously supplied to school gardening programs
Personnel	5 workers	1-2 workers
Years of operation	<1 year	>3 years (exact unknown)

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Notes	Part of the zero-waste market initiative, detailed records of compost activity are kept.	Operation is irregular and dependent on sawdust supply. Poor record-keeping of composting activity.

**this value is taken from an interview with Mr. Ted Velasco, but should be double-checked*

These differences are highlighted less for the purpose of identifying a better composting system, but more as an illustration of different examples in market waste composting. Because of the complexities in waste management, composting systems should reflect the specific and local demands for waste management. Adjusting to these demands may include tailoring machines to a specific type of waste or labor input, aligning composting activity with waste collection schedules, or establishing partnerships with private or informal waste services. These considerations, however, are not comprehensive or definitive. As briefly introduced in the section *perspectives in waste management*, it is therefore critical to research and involve the many actors involved in food markets to develop a sustainable and appropriate waste management plan.

Challenges and recommendations in waste management

Unsurprisingly, the proper segregation of waste is a necessary point of improvement. Segregating waste supports the subsequent diversion or recovery of waste categories, reducing the overall burden on landfills. *Proper* segregation is important to protect waste processing machinery and outputs. For example, the contamination of organic waste with small plastics can damage composting machines as well as incorporate microplastics into the produced soil conditioner. Vendors are required by RA 9003 to segregate their waste at source; however, there is limited monitoring, especially for talipapa or informal vendors. In Quezon City, waste segregation trainings are offered, but not required to obtain a business permit, creating a policy environment where segregation is not actively enforced.

A significant component to the mentality and commitment of vendors (and households) towards waste segregation are the visible benefits for what might be perceived as “extra effort”. As Garcia shares, vendors best follow waste segregation practices when their livelihoods are directly affected. This is especially the case after flooding events, where waste accumulation clogs drains and exacerbates flooding. Awareness campaigns on the importance of waste management could utilize this pattern to maximize the impact of natural events on improving waste segregation efforts. It should be noted, however, that improvements in waste segregation efforts cannot be solely reliant on catastrophic natural events.

Even where market vendors are segregating their waste, small plastics such as rubber bands or small bags are still found in the organic waste supplied to composting machines. To expect these items to be perfectly segregated is an optimistic goal, given that these items are most likely overlooked instead of intentionally mis-categorized. Therefore, it is especially important to promote biodegradable alternatives for the *small* items used in food packaging. The benefits from this are not only in the reduction of non-biodegradable wastes, but also in the quality of soil conditioner produced at the markets. By reducing the plastics used in the market, there is a lower risk of microplastic contamination in the soil conditioner made, and ultimately applied to food production.

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Another challenge, described by the Kamuning market administration, is the potential impact of pesticides from leafy vegetables to the soil conditioner. The administration office elaborates that the outer layers of vegetables have the greatest pesticide content and are also the layers most discarded. They question, therefore, if the soil conditioner produced mostly from pesticide-rich food scraps is still suitable for agriculture. Frequent soil tests are therefore important to ensure the continued safety of the soil conditioner.

The composting initiatives in both Kamuning Market and Pasay Public Market are impressive accomplishments in market waste diversion. The scalability of these initiatives, however, is important to research as both administrations describe limitations in the supply of non-food waste inputs. In Kamuning Market, charcoal supplies were gathered from public markets throughout Quezon City for the operation of one composting machine. Although the charcoal demand is currently met, this may not continue if more composting machines are established. In Pasay Public Market, the impacts of insufficient inputs are already in effect as the machine frequently stops operation when sawdust supplies run out. To encourage and support the extension of composting activity, it is therefore important for market offices and researchers to scope alternative options for non-food waste inputs.

The utilization of the soil conditioners produced from composting activity is another important perspective in waste management. In both Kamuning and Pasay Public Market, the soil conditioners produced are distributed to recipients free of charge. In Kamuning Market, there is a consistent demand for soil conditioner from the Joy of Urban Farming initiative. In Pasay Public Market, however, there is no regular recipient of the soil conditioner. Although the market office mentions that the excessive accumulation of non-distributed soil conditioner is not an issue, this example illustrates the necessity for compost production to be paired with strategies to encourage local agriculture and compost use.

Another important aspect to waste management is the distinction between city- and private-owned food markets. Both Kamuning and Pasay Public Market are city-owned public markets, which allowed the city government to support composting initiatives and monitor proper compliance to RA 9003. In private-owned markets, however, there is less city involvement and monitoring less frequent than in their city-owned counterparts. As a result, private markets might be dirtier than public markets, as seen in the comparison between Commonwealth (private) and Kamuning (public) Market.

Finally, in a digression from food waste, the Pasay CENRO describes special waste disposal as a challenge for waste management in Pasay Public Market. This is partially because of the administrative complications in hiring a special waste collection truck from private waste collection providers. It may be interesting, however, to review the overlap between informal waste scavengers and the management of special wastes. The coordination between market administration offices and scavengers/junkshop workers could potentially create a triple-win scenario: lower waste collection costs, greater job opportunities for the urban poor, and more timely collection of special wastes.

Scope and limitations of the report

Within the broad topic of waste management, this report focuses on biodegradable waste and composting processes at the food market level. Because the case studies on Quezon

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City and Pasay City feature Kamuning Market and Pasay Public Market, respectively, the report has a bias towards city-owned public markets. During data collection, privately-owned markets were more difficult to access because of the greater difficulty of making contact and setting up meetings with market administration officials. Furthermore, there is limited insight included on the issue of waste management in *talipapa* markets and informal vendors / street hawkers because of restrictions with time. Likewise, it was also difficult to contact and interview informal scavengers and waste collectors. The scope of the study therefore focused on physical city-owned public markets because the vendors were stationery and information on vending and waste activity was more accessible from administrative offices.

Another limitation in this report is the accuracy of the findings on compost activity. Because interviews and meetings were predominantly with government administration offices, the insight from these groups may be an optimistic description of the reality at these markets. Furthermore, it was difficult to retrieve quantitative data from these offices, so many of the figures and statistics used for quantitative analysis were sourced from previous years. Because of this, data analysis between Kamuning and Pasay Public Market are difficult to compare in terms of quantitative impact.

In conclusion, because the sampling used in this report has been limited, it is strongly recommended to carry out further analysis of available quantitative information, seek out additional statistics (see Annex M for further suggestions about data sources), and continue interviewing different actors, especially targeting the informal sector and actors employed in waste collection services.

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References

Adkranz. (2014, December 29). *Metro Manila in the Philippines*. Wikimedia. https://upload.wikimedia.org/wikipedia/commons/c/c6/Metro_Manila_in_the_Philippines.png

AECOM. (2016). Integrated Solid Waste Management Plan Quezon City. In *Asian Development Bank* (TA-8566 REG). Asian Development Bank. https://events.development.asia/system/files/materials/2016/09/201609-integrated-solid-waste-management-plan-quezon-city.pdf

Asian Development Bank. (2004). The Garbage Book: Solid Waste Management in Metro Manila. In *Asian Development Bank*. https://www.adb.org/publications/garbage-book-solid-waste-management-metro-manila

Bennett, E. M., & Alexandridis, P. (2021). Informing the Public and Educating Students on Plastic Recycling. *Recycling*, *6*(4), 69–91. https://doi.org/10.3390/recycling6040069

Cabico, G. K. (2020, January 16). After nearly 20 years, court finds Quezon City liable for Payatas tragedy. *Philstar*. https://www.philstar.com/nation/2020/01/16/1985298/after-nearly-20-years-court-finds-quezon-city-liable-payatas-tragedy

Commission on Audit. (n.d.). Solid Waste Management Pasay City Audit Executive Summary. In *Commission on Audit*. Commission on Audit Philippines. Retrieved November 17, 2022, from https://www.coa.gov.ph/download/2188/solid-waste-management/28270/city-government-of-pasay-ms-report-no-2002-02b-executive-summary.pdf?__cf_chl_tk=D1UfyRdbFqqYadZqQ.JbvS3kpeM985yIm7d2OJIHbuE-1669053721-0-gaNycGzNCP0

Congress of the Philippines. (2001, January 26). *Republic Act No. 9003* [Press release]. https://www.officialgazette.gov.ph/2001/01/26/republic-act-no-9003-s-2001/

Environmental Management Bureau Department of Environment and Natural Resources. (2018). National Solid Waste Management Status Report [2008-2018]. In *GOV.PH*. Department of Environment and Natural Resources. https://emb.gov.ph/wp-content/uploads/2019/08/National-Solid-Waste-Management-Status-Report-2008-2018.pdf

Environmental Management Bureau Department of Environmental and Natural Resources. (2021). 2020 Regional State of Brown Environment National Capital Region. In *GOV.PH*. Department of Environmental and Natural Resources. https://ncr.emb.gov.ph/wp-content/uploads/2021/08/2020-EMB-NCR-RSOBER-COMPRESSED.pdf

EPA Office of Resource Conservation and Recovery. (2020). Best Practices for Solid Waste Management: A Guide for Decision-Makers in Developing Countries. In *United States Environmental Protection Agency* (EPA 530-R-20-002). United States Environmental Protection Agency. https://www.epa.gov/international-cooperation/solid-waste-management-guide-developing-countries

MMDA Corporate Planning and Management Staff. (2021). Highlights of Accomplishment Report: 2021 Annual Report. In *Metropolitan Manila Development Authority*. Metropolitan

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Manila Development Authority (MMDA). https://mmda.gov.ph/images/pdf/Transparency/VII/ExecutiveSummary-FY2021.pdf

QC MDAD. (2022). Project Zero Waste Public Market. In *QC GOV.PH*. Quezon City Market Development and Administration Department.

Quezon City Council. (2015). Ordinance No. SP-2459, S-2015. In *Quezon City Council*. Republic of the Philippines.

Quezon City Environmental Management Program. (2021). EcoProfile Chapter 5: Solid Waste. In *QC GOV.PH*. Quezon City. https://quezoncity.gov.ph/wp-content/uploads/2021/01/Eco_Profile_2018_Chapter-5.pdf

Rentoy, F. C. (2012). Solid Waste Management City Profile: Quezon City, Philippines. In *Climate and Clean Air Coalition Municipal Solid Waste Initiative*. Environmental Protection and Waste Management Department (EPWMD). Retrieved November 3, 2022, from http://waste.ccac-knowledge.net/

Republic of the Philippines Department of Environment and Natural Resources Environmental Management Bureau. (n.d.). *Solid Waste Management Data*. GOV.PH. Retrieved November 17, 2022, from https://emb.gov.ph/solid-waste-management-data/

Republic of the Philippines Environmental Management Bureau Solid Waste Management Division. (n.d.-a). *10-Year Solid Waste Management Plan*. GOV.PH. Retrieved November 17, 2022, from https://app.powerbi.com/view?r=eyJrIjoiMTNiMmM0NWQtMjE4Yi00M2M2LWJiNjAtMGUxOTc0MjA1NTczIiwidCI6ImY2ZjRhNjkyLTQzYjMtNDMzYi05MmIyLTY1YzRlNmNjZDkyMCIsImMiOjEwfQ%3D%3D&pageName=ReportSection

Republic of the Philippines Environmental Management Bureau Solid Waste Management Division. (n.d.-b). *National Solid Waste Management Commission — Secretariat*. GOV.PH. Retrieved November 17, 2022, from https://nswmc.emb.gov.ph/

Republic of the Philippines Environmental Management Bureau Solid Waste Management Division. (n.d.-c). *Operational Sanitary Landfill*. GOV.PH. Retrieved November 17, 2022, from https://app.powerbi.com/view?r=eyJrIjoiMjE5OGY4MDQtMTkwYy00NGFiLWJjNzAtNjc0MTRjNmZmMWYzIiwidCI6ImY2ZjRhNjkyLTQzYjMtNDMzYi05MmIyLTY1YzRlNmNjZDkyMCIsImMiOjEwfQ==

Republic of the Philippines Environmental Management Bureau Solid Waste Management Division. (n.d.-d). *Projected Waste Generation from 2020 to 2025*. GOV.PH. Retrieved November 17, 2022, from https://app.powerbi.com/view?r=eyJrIjoiNjc4OTE2OTktMDdhMC00YzM1LTkwMjEtYWUxMDIyMjI0MWMwIiwidCI6ImY2ZjRhNjkyLTQzYjMtNDMzYi05MmIyLTY1YzRlNmNjZDkyMCIsImMiOjEwfQ%3D%3D&pageName=ReportSection&fbclid=IwAR264Sfm3ocnSBovLnpGgdSKXljXQeGAx9JpZIxcAS3YyV4voqVpHzPTBNw

Senate Economic Planning Office (SEPO). (2017). Philippine Solid Wastes: At a Glance. In *Senate of the Philippines* (AG-17-01).

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http://legacy.senate.gov.ph/publications/SEPO/AAG_Philippine%20Solid%20Wastes_Nov2017.pdf

Tetra Tech, Leon, C., & Stirrat, B. A. (2020). Clean Cities, Blue Ocean: Initial Solid Waste Management Assessment – Philippines. In *United States Agency for International Development*. Tetra Tech. https://pdf.usaid.gov/pdf_docs/PA00XWPH.pdf

The Old Farmer's Almanac. (2022, April 22). *Plastics Identification and Recycling Chart*. Almanac. https://www.almanac.com/which-plastics-are-recyclable-number

United Nations Development Programme Philippines, Lor, R., Palmos, G. A., & Voroncova, E. (2021). Circular Economy in the City: A Rapid Ethnographic Research on Circular Economy in a Philippine Urban Setting. In *United Nations Development Programme*. https://www.undp.org/philippines/publications/circular-economy-city-rapid-ethnographic-research-circular-economy-philippine-urban-setting

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ANNEXES

A. RA 9003 Compliance by Metro Manila LGUs

	SWM Plan Status	# Barangays with MRFs	SWM Organization	Annual LGU Budget for SWM (PHP)
Caloocan City	Approved 2015-2024	127/188	Environmental Sanitation and Services	
Las Piñas City	Approved 2015-2024	20/20		268,268,201
Makati City	Approved 2014-2023	10/33	Solid Waste Management Division	700,194,595.64
Malabon City	Approved 2015-2024		City Environmental and Natural Resources Office (CENRO)	109,750,000
Mandaluyong City	Approved 2015-2024	27/27	City Environment Management Department	
Manila City	Approved 2015-2024	645/897	Department of Public Service	1,065,211,151
Marikina City	Approved 2014-2023	6/16	City Environmental Management Office	198,000,000.00
Pateros Municipality	Approved 2019-2028	2/10		20,510,076.76
Muntilupa City	Approved 2015-2024	2/9	Environmental Sanitation Center	370,178,050.41
Navotas City	Approved 2014-2023	14/14	City Environmental and Natural Resources Office (CENRO)	30,000,000
Parañaque City	Approved 2014-2023	3/16	Solid Waste and Environmental Sanitation Office	25,000,000
Pasay City	Approved 2015-2024	156/201	City Environmental and Natural Resources Office (CENRO)	418,691,600
Pasig City	Approved 2015-2024	8/30	Solid Waste Management Office	346,835,408
Quezon City	Approved 2015-2024	58/142	Environmental Protection and Waste Management Department	497,000,000
San Juan City	Approved 2015-2024		City Environmental and Natural Resources Office (CENRO)	130,000,000
Taguig City	Approved 2015-2024	28/28	Solid Waste Management Office	
Valenzuela City	Approved 2013-2022		Waste Management Division	409,357,857

**Data from public statistics from the Environmental Management Bureau (2022)*

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B. Contacts and information sources for waste management and schedule of interviews

Pasay City

City Mayor: Imelda Calixto Rubiano
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Tel. 6328 551 1974

Chief of Staff: Peter Eric Pardo
cos_pedpardo@pasay.gov.ph
Tel. 0960 849 7522

Pasay Public Market Information Technology Officer II, OIC: Teodoro N. Velasco
tnvelasco1101@gmail.com
Tel. 0928 792 0195

City Planning Officer: Achilles Rabiso

Pasay City Environmental and Natural Resources Office (CENRO) City Engineer I, OIC: Renato A. Sanchez
Tel. 551-9798, 401-5550

Senior Staff for Solid Waste at CENRO: Nenette Losabia
Tel. 0927 978 8219

Barangay 91/92 Leader: Adrian Ferrer
Tel. 0943 132 8218

Officer at Pasay Public Market Administration: Mark (surname unknown)

CENRO Supervising Administrative Officer: Ronald Rae M. Salvador, RN
Ronaldrae14@gmail.com, rsalvador@pasay.gov.ph
Tel. 0977 817 6268; 0916 483 1222; 02 8551 9798

Public Information Office Acting City Administrator: Cresalita I. Rey, CPA
Tel. 831-6459

Quezon City

City Mayor: Josefina G. Belmonte
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MDAD Public Market Division Head: Elmer Ferran
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Officer at Kamuning Market Administration: Ed Bainto
Tel. 0998 970 1288

Interviews Conducted

Date	Office	Individual(s)
September 3, 2022	Pasay Public Market Administration Office	Ted Velasco
September 3, 2022	Commonwealth Market	Waste collector (name unknown)
October 13, 2022	Manila Market Administration Office	Randell Manjarres
October 13, 2022	Quezon City MDAD	Jeremiah A. Garcia
October 13, 2022	Divisoria Market Barangay Office	Ruben Iagarto
October 18, 2022	Kamuning Market Administration Office	Ed Bainto
October 18, 2022	Kamuning Market	Market vendor (name unknown)
October 18, 2022	Pasay City ENRO Office	Nenette Losabia Adrian Ferrer Ronald Rae M. Salvador (briefly)
October 18, 2022	Pasay Public Market Administration Office	Mark (surname unknown)

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C. Waste Generation in Metro Manila by LGU

	Waste Generation (kg/day)	Waste Composition (kg/day)				Waste Diversion (%)
		Biodegradable	Recyclable	Special	Residual	
Caloocan City	846,396	409,873	205,780	215,310	15,433	49.0%
Las Piñas City	345,278	95,746	134,728	69,988	44,817	54.7%
Makati City	655,001	238,355	306,671	1,310	108,655	50.0%
Malabon City	301,930	126,629	66,727	21,890	86,684	69.6%
Mandaluyong City	273,178	127,026	86,885	38,607	20,660	53%
Manila City	1,030,160	515,080	329,651	133,921	51,508	32%
Marikina City	449,815	69,503	167,303	131,719	81,290	50%
Pateros Municipality	46,166	26,530	14,479	4,654	503	10%
Muntilupa City	202,898	88,090	62,429	51,750	629	39%
Navotas City	82,020	32,562	26,657	8,571	14,230	59%
Parañaque City	697,931	197,953	347,185	66,450	86,343	58%
Pasay City	340,000	140,080	138,380	39,440	22,100	59%
Pasig City	392,000	148,960	1,776,400	7,840	58,800	56%
Quezon City	2,645,001	1,426,978	536,935	1,185,150	495,938	55%
San Juan City	49,166	29,761	13,392	5,649	488	15%
Taguig City	94,133	101,566	48,485	16,543	27,539	75%
Valenzuela City	200,000	92,000	76,000	2,000	30,000	

Data from Environmental Management Bureau public statistics

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D. Market Waste Observations Log

[Pasay Public Market, October 18, 2022] Waste at vendor stalls is collected in plastic bags. Commonly observed waste is product of spoiled vegetables and unmarketable produce. Whole produce is rarely seen in the market waste; this is usually chopped parts, leaves, stems, etc.

[Pasay Public Market, October 18, 2022] Recyclable materials, cardboard and PET bottles, are collected separately. There is another PET bottle collection site in the vending areas of the market so consumers are incentivized to dispose of PET bottles separately.

[Pasay Public Market, September 3, 2022] Collection of non-biodegradable wastes from the market stalls. There is an abundance of plastic bags. This waste is treated with a liquid to control odor.

[Commonwealth Market, September 3, 2022] Pile of waste observed on a sidewalk near vending stalls. Consists of paper, outer cabbage leaves, and pineapple heads (discarded parts of produce processing)

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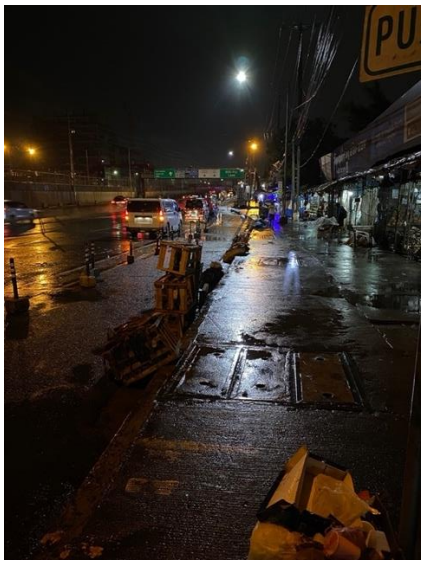

[Commonwealth Market, September 3, 2022] Special wastes (wooden crates) observed piled near the main road on the outer edge of the market. The crates are in medium to poor condition with the potential for re-use, but are piled for disposal.

[Commonwealth Market, September 3, 2022] Waste from several vending stalls is consolidated in a pile by the walkways to be picked up by waste collector. Not all waste is properly consolidated into the pile, discarded scraps were commonly seen along the walkway.

[Commonwealth Market, September 3, 2022] Waste hauled into truck. Most of the waste is not in a bag, and types of waste which should be segregated are mixed in the truck. The market waste collection worker also mentioned he does not segregate waste after collection (only special/bulky waste is separated).

[Commonwealth Market, September 3, 2022] Waste observed in the meats section. Contrary to insight from interviews which suggest minimal meats are wasted, chicken legs which are otherwise marketable are seen in the bags. These are potentially spoiled and can no longer be sold. Lots of plastic waste observed in the meat section.

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[Divisoria Market, October 13, 2022] Hearts of the coconut palm (ubod) cut for better marketability. The Divisoria waste management office describes the discarded outer layers of the ubod as the biggest component of waste generation in the market because of the volume of waste from one “ubod” / coconut heart.

[Divisoria Market, October 13, 2022] Outer leaves of cabbage discarded. These may be packaged into plastic bags to sell or donate as animal feeds. However, not all leaves are properly put in bags, and there are many leaf scraps seen on the market floor.

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E. Waste collection service providers and facilities for Metro Manila by LGU

LGU	Contractor	Location
Caloocan	ISWIMS Inc.	San Mateo, Rizal
Las Pinas	LEG Hauling Services Corporation	Rodriguez, Rizal
Makati	ISWIMS Inc.	San Mateo, Rizal
Malabon	Leonel Waste Management Corporation	Navotas Sanitary Landfill
Mandaluyong	IPM	Rodriguez, Rizal
Manila	Leonel Waste Management Corporation	Navotas Sanitary Landfill
Marikina	ISWIMS Inc.	Rodriguez and San Mateo, Rizal
Muntinlupa	Leonel Waste Management Corporation	Rodriguez, Rizal
Navotas	Phileco	Navotas Sanitary Landfill
Paranaque	Leonel Waste Management Corporation	Rodriguez, Rizal
Pasay	IPM	Rodriguez, Rizal
Pasig	IPM	Rodriguez, Rizal
Pateros	Leonel Waste Management Corporation	Rodriguez, Rizal
Quezon City	1. ISWIMS Inc.	Rodriguez, Rizal
	2. Dominus	Rodriguez, Rizal
	3. Atlas	Rodriguez, Rizal
	4. Steriplus	Rodriguez, Rizal
San Juan	Metrowaste Solid Waste Management Corporation	Rodriguez, Rizal
Taguig	1. IPM	Rodriguez, Rizal
	2. Leonel Waste Management Corporation	Rodriguez, Rizal
Valenzuela City	ISWIMS Inc.	San Mateo, Rizal

Data from the Environmental Management Bureau public statistics

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F. Non-Residential Wastes from Quezon City

Main Activity	2015	2016	2017
Manufacturer/Producer/Repacker	1,056	1,026	1,028
Wholesaler	6,270	6,724	7,216
Exporter	85	88	79
Retailer	16,348	16,488	16,905
Contractor	19,459	20,255	21,325
Financial Institutions	2,772	2924	3,164
Franchise Holder	10	9	9
Restaurant and Eating Establishment	3,000	3,364	3,428
Proprietor, Lessor, and Operator Hotels/Motels/Inns/Pension/Boarding/Other Lodging	6,901	7,180	7,431
Amusement Center, Establishment, Bars, Cocktail Lounge, Gaming Activities and Social Recreation	441	459	526
Proprietor, Lessor and Operators Shopping Center and Private Markets	46	50	57
Importer	1,262	1,228	1,278
Learning Institution	575	579	579
Other Business and Business with Fix rates	4,448	4,621	4,872
Multiple Activity	4,417	4,202	4,421
Unknown Activity	6	7	11
Total	67,096	69,204	72,329

Data from the 2018 EcoProfile on Quezon City

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G. Kamuning Market Rapid Composting Machine Activities

Observed: composting activity at 9:00AM October 18, Kamuning Market. Vegetable scraps are collected in the morning from market vendors by Excellence staff and brought to the composting site. Mostly collected are scraps from leafy greens because they are more prone to spoilage. Depending on the day, there may also be fish gills/scales included in the mix. Observed are primarily kangkong, camote taps, with also some cabbage, squash, carrots, and sayote. Paper waste from vendor stalls are also included in the pile. Non-compostable items such as rubber bands or pieces of plastic are occasionally found in the mix and manually removed; however, this method is imperfect and small plastics can be observed in the compost output.

The vegetable waste is first dumped into a rectangular receptacle, where it is then mixed with collected charcoal (Uling) and sawdust. The charcoal is collected from other markets in the city and brought to Kamuning for the composting activity. Mixing is done manually with the use of a large metal rake. The waste is treated with liquid odor eliminator (see image at the end of this Annex). In total the inputs are approximately 100kg organic waste, 10kg charcoal, and 5kg sawdust. 5 workers are involved in the entire composting process both in the morning and afternoon.

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After mixing the inputs in the tray, a small crate is filled (blue). The workers dump the contents of the small crate into the composting machine (through the green side of the machine). This is done to avoid over-exerting the machine. The machine runs continuously, and inputs are supplied crate by crate until all the inputs have gone through the machine. This usually takes approximately one hour. Sometimes the compost is put through the machine a second time to further break down the inputs. The necessity of this second run depends on the weather and vegetable waste collected that day. Without any formal measurements, the workers feel the compost output to decide whether to re-run the compost through the machine.

The compost machine shreds and rotates the inputs in the main chamber. No heating is involved in the processing, and liquid waste exits this chamber through an orange pipe. Currently, the liquid waste is not utilized; however, the Kamuning market administration shares intent of harvesting the liquid waste and include this in the zero-waste project. Workers inspect the proper operation of the machine through the metal hatch on the side wall (shown). The material is then squeezed through a small opening and exits the machine. The workers use a wooden stick to brush the material off the opening into a metal tray to avoid clogging the exit point. Plastics such as shredded rubber bands are visible as the material exits the machine, indicating issues in waste segregation and the removal of plastics / other contaminants before machine processing.

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When the metal tray is filled, it is removed from the opening of the composting machine and replaced by a plastic bucket. This plastic bucket temporarily collects compost while the metal tray is weighed on a nearby scale. After subtracting the tray weight, the mass of compost is recorded, where it is then carried to rectangular receptacle to dry (separate from the receptacle where the inputs were mixed). After dumping the compost, the empty metal tray is returned to the opening of the composting machine, replacing the plastic bucket. Contents of the plastic bucket are dumped into the metal tray.

This process continues until all the inputs have passed through the machine, weighted, and dumped into the second receptacle. The compost is spread thinly on the receptacle and left for three days to dry. During the drying period, the compost is manually mixed to promote even drying. Compost from the previous day is seen on the bottom, with a visibly lighter color. On occasion, a 1kg soil sample is taken from this receptacle and sent to the bureau of soils for testing. At the time of visit, this testing has only been done once; however, the market administration intends to request soil testing on a quarterly basis to ensure suitability for its use as a soil conditioner.

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After the compost is sufficiently dried, it is packaged into 30kg sacks. These sacks are distributed to the Joy of Urban Farming initiative, also based in Quezon City. 15 sacks are produced per month, equivalent to 450kg of soil fertilizer produced monthly. The distribution to the farming initiative does not follow a regular schedule. Until the decision is made to transport the sacks, they are collected outdoors on the ground in the area with the composting machine and input mixing + compost drying receptacles.

Image of odor neutralizer used to treat the organic waste inputs before entering the composting machine. The market administration comments that the neutralizer does not pose any harmful consequences for the compost produced. When the composting activity first started, the odor neutralizer was not used. However, there were many insects and pests that were attracted to the compost inputs which caused issues for both hygiene and the operation of the machine. In response, the administration began to apply the odor neutralizer. During the visitation, the compost area was surprisingly odor free.

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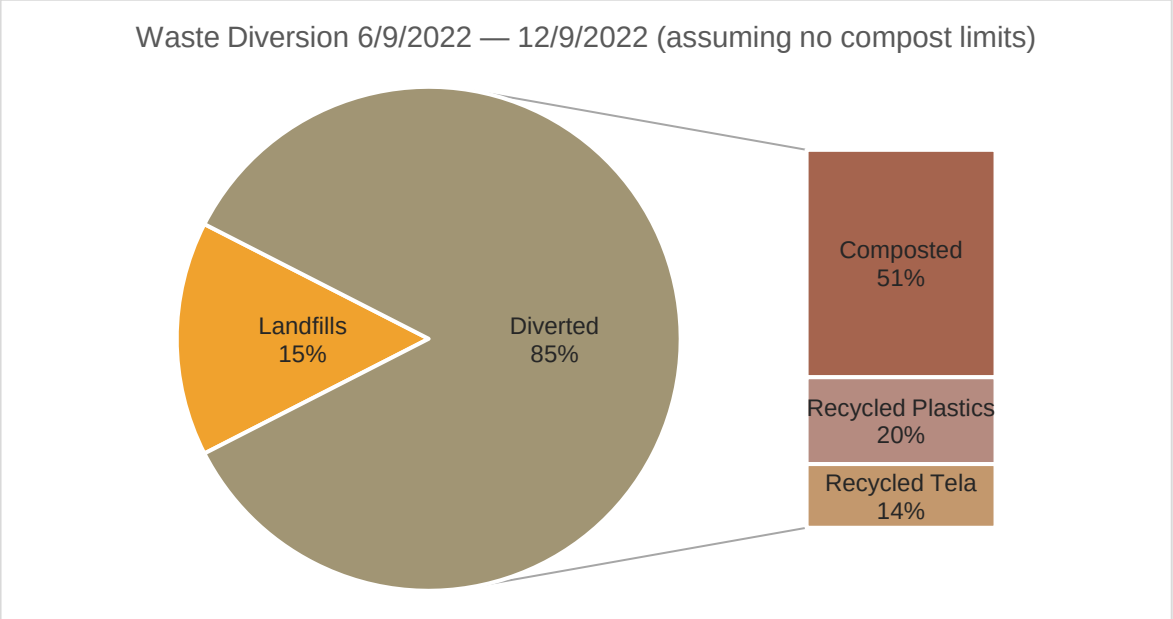
H. Kamuning Market Composting Calculations (assuming all possible compost inputs are processed)

ASSUMPTION: All possible inputs are composted



Total Waste (kg)	Composted Waste (kg)	Plastic Waste (kg)	Textile (*tela*) Waste (kg)	Total Diversion (kg)	Total Diversion (%)
3153.5	1612.0	615.5	451.5	2679.0	85%

Original data from kamuning market compost machine records

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I. Waste Recovery in Pasay 2015

Date	Recyclable	Compost-able	Overall	Date	Recyclable	Compost-able	Overall
Jan 1-15	31.38%	15.69%	47.07%	Jul 16-31	32.91%	16.12%	49.03%
Jan 16-31	32.59%	16.30%	48.89%	Aug 1-15	32.20%	15.78%	47.98%
Feb 1-15	20.58%	10.09%	30.67%	Aug 16-31	32.05%	16.03%	48.08%
Feb 16-28	3.02%	41.77%	44.79%	Sept 1-15	31.60%	15.80%	47.40%
Mar 1-15	32.19%	16.10%	48.29%	Sept 16-31	32.21%	15.78%	47.99%
Mar 16-31	32.88%	16.44%	49.32%	Oct 1-15	32.03%	15.70%	47.73%
Apr 1-15	32.17%	16.08%	48.25%	Oct 16-31	32.56%	15.95%	48.51%
Apr 16-31	32.11%	15.73%	47.84%	Nov 1-15	32.17%	16.08%	48.25%
May 1-15	32.19%	16.09%	48.28%	Nov 16-31	32.04%	16.02%	48.06%
May 16-31	32.40%	16.20%	48.60%	Dec 1-15	32.49%	16.25%	48.74%
Jun 1-15	32.87%	16.10%	48.97%	Dec 16-31	32.59%	16.29%	48.88%
Jun 16-31	32.04%	15.70%	47.74%	Total	30.55%	16.84%	47.39%
Jul 1-15	32.04%	16.02%	48.06%				

Data from the Pasay City 10-year solid waste plan

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J. Pasay Public Market Rapid Composter Machine Activities

Inputs for the composting machine are vegetable scraps, fish scales/gills, and sawdust. The vegetable and fish scraps are collected from the Pasay Public Market and brought to the composting site by a waste collector employed by the Pasay Public Market office. As seen in the image, paper is also included in the collection of scraps from the market. However, the compost officer describes that this is not an issue for the operation of the machine. Unlike in Kamuning Market, the wastes collected from the market and used for composting are not formally recorded. Specific ratios are used for these inputs that are listed in Annex M. It was not possible to observe the composting activity in action at Pasay; however, this pile of inputs was left over on the site during visitation.

Sawdust inputs for the composting machine are sourced solely from a nearby toothpick factory. The supply of sawdust provided by the factory is irregular, coming only once every few weeks. The operation of the composting machine is heavily dependent on the avilability of sawdust, so after the sawdust supply is depleted, the machine is inactive until the factory sends more sawdust. The interviewed compost worker shares that this pause in composting activity is frequent. During this time, other inputs such as the organic wastes from the market are not collected. It is unclear where this waste goes during this time.

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After the inputs for the composting machine are mixed on the ground, they are fed through a shredder (bright green machine on the left). Afterwards, it is shoveled into the composting machine. This machine was donated by the Department of Science and Technology (DOST) and is significantly larger than the one in Kamuning Market. The machine has a maximum capacity of 1000kg/day. The bioreactor usually operates at maximum capacity; therefore, if the amount of organic waste generated at the market increased, the compost worker shares that another machine would be needed. The compost worker describes that the inputs go through the reactor for a total of three cycles. When in operation, the machine runs continuously for 24 hours.

The compost machine slowly and continuously rotates the input material. Gases produced from the decomposition of the input material are trapped in the machine, collecting heat which further accelerates the decomposition process. There is no heating that is manually added by the machine to supplement decomposition and composting processes. Many cockroaches and other insects were observed inside the composting machine. Aside from the cleanliness of the workspace, the compost worker shares that it is not a large issue for the composting activity.

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After the material is processed by the composting machine, it is brought to the first cage area (left). The material is spread out to dry and mixed with any material that was already in this space. The material in these cages is manually mixed and sifted every two weeks. After a few weeks, dry material from the first cage area is moved to the second cage area (right). In total, the compost worker shares that it takes an average of 5 months for the material to fully dry to form the ideal soil conditioner. It should be noted, however, that new material is also continuously brought into the cages, so it is unclear how the cutoff of 5 months is estimated.

The final soil conditioner produced is dry and flaky. When there is rainy weather, it may take longer for the input material to reach this texture / ideal moisture. The compost workers judge when the soil conditioner is in its idea by observation rather than formal measurements. The finished soil conditioner has historically been sent to local schools for school gardening projects. During the pandemic, however, this activity was halted. The compost worker shares that there are no regular customers for the soil conditioner. Finished products are only shipped to customers when they are requested, so there is often a buildup of soil conditioner produced at the market.

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K. Input Ratios for the Pasay Public Market Composting Machine (Digitized)

Vegetable Waste, etc (kg)	Fish Waste / Animal Manure (kg)	Sawdust / Coco Coir Dust (kg)	Total (kg)	Vegetable Waste, etc (kg)	Fish Waste / Animal Manure (kg)	Sawdust / Coco Coir Dust (kg)	Total (kg)
188	33	112	333	141	25	84	250
187	33	111	331	140	25	83	248
186	33	111	330	139	25	83	247
185	33	110	328	138	24	82	244
184	33	110	327	137	24	82	243
183	32	109	324	136	24	81	241
182	32	108	322	135	24	80	239
181	32	108	321	134	24	80	238
180	32	107	319	133	24	79	236
179	32	107	318	132	23	79	234
178	32	106	316	131	23	78	232
177	31	105	313	130	23	77	230
176	31	105	312	129	23	77	229
175	31	104	310	128	23	76	227
174	31	104	309	127	23	76	226
173	31	103	307	126	22	75	223
172	30	102	304	125	22	74	221
171	30	102	303	124	22	74	220
170	30	101	301	123	22	73	218
169	30	101	300	122	22	73	217
168	30	100	298	121	21	72	214
167	30	99	296	120	21	71	212
166	29	99	294	119	21	71	211
165	29	98	292	118	21	70	209
164	29	98	291	117	21	70	208
163	29	97	289	116	21	69	206
162	29	97	288	115	20	69	204
161	29	96	286	114	20	68	202
160	28	95	283	113	20	67	200
159	28	95	282	112	20	67	199
158	28	94	280	111	20	66	197
157	28	94	279	110	20	66	196
156	28	93	277	109	19	65	193
155	27	92	274	108	19	64	191
154	27	92	273	107	19	64	190

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153	27	91	271	106	19	63	188
152	27	91	270	105	19	63	187
151	27	90	268	104	18	62	184
150	27	89	266	103	18	61	182
149	26	89	264	102	18	61	181
148	26	88	262	101	18	60	179
147	26	88	261	100	18	60	178
146	26	87	259	99	18	59	176
145	26	86	257	98	17	58	173
144	26	86	256	97	17	58	172
143	25	85	253	96	17	57	170
142	25	85	252	95	17	57	169

L. Waste Flow at Commonwealth Market

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M. Notes for further data collection

Access to statistics and records are a significant limitation to this report. After numerous letters and visits to market administration and city government offices in Pasay City and Quezon City, copies of these documents were not yet shared. Although some forms of information requested may not be available in these offices, some records are proven to exist. Below is a brief description of documents that were discussed in meetings with different actors for the waste management report.

Document	Scale	Notes
WACS (Waste Analysis and Characterization Survey) Report	Pasay City and Quezon City	A WACS report is a required aspect of the 10-year solid waste management plan submitted by LGUs. Officially, the WACS report is supposed to be submitted every 3 years. The report is expected to also be available at the Metro Manila scale and for other LGUs in the region.
Soil Test Results	Pasay Public Market and Kamuning Market Composting Units	Both the composting activities in Pasay Public Market and Kamuning Market have sent soil samples to the Bureau of Soils for testing. The Kamuning Market administration has shared that they have received results from their first soil test. The Pasay Public Market shared that they still await results from the soil test. Kamuning market shares that they intend to submit soil samples to the Bureau of Soils for testing on a quarterly basis.
Compost machine records	Kamuning Market	The Kamuning Market administration office had records of the waste collected at the market and inputs used for the composting activity. The records physically available at the office were photographed, but these were only data from the span of two weeks. The office also indicated that they would share backlogs of these records, but these are yet to be received after several follow-up messages.
Compost machine records	Pasay Public Market	Administrative processes at the Pasay Public Market are limited. Records of inputs and outputs of the composting machine are officially existent according to the Pasay City CENRO, but at the market office, this does not exist. Previous records were supposedly destroyed in a flood, and current records consist of only limited two sentence notes (see appendix).

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Financial savings and energy usage calculations	Kamuning Market Composting Unit	During the interview at Kamuning market, administration officers mentioned the existence of a report with calculations of energy inputs and financial savings from the operation of the market composter. This report was requested during the visit and through follow-ups but is yet to be shared. The report would be helpful in assessing the sustainability of the composting machine, as well as quantifying the benefits not only through reduction in waste but from an economic perspective.
Soil Conditioner distribution records	Pasay Public Market and Kamuning Market	Administration officers for these markets shared information on where the soil conditioner is typically sent. However, there were no records or written documents of this activity. Information on how the soil conditioner is used would be insightful in tracing the impact of composting activity beyond waste reduction, but potentially also in urban agriculture or education.
Presentation of the Zero-Waste Project	Quezon City	During the visit to the Quezon City MDAD, Mr. Jerry Garcia described that the zero-waste project had several presentations and reports that could be made available. While those made available to the public were consulted, follow up on retrieving more materials is recommended (for more quantitative data).

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