

# Reaching Inaccessible Communities: Demonstration of Community-Based Solid Waste Management Sub-System in Metro Manila, Philippines

Guinevere S. Constantino<sup>1</sup>, Kristine Ann M. Luna<sup>1\*</sup>, Anne Louise T. Toleza<sup>1</sup>, Reynaldo R. Medina<sup>1</sup>

<sup>1</sup> Woodfields Consultants, Inc.,  
Quezon City, PHILIPPINES

\*Corresponding Author: [kristine.ann18@gmail.com](mailto:kristine.ann18@gmail.com)

DOI: <https://doi.org/10.30880/ijie.2025.17.04.022>

## Article Info

Received: 27 February 2025

Accepted: 6 November 2025

Available online: 20 November 2025

## Keywords

Integrated solid waste management, solid waste management system, solid waste collection and transportation, community-based programs, Philippines

## Abstract

In Metro Manila, Philippines, numerous communities remain inaccessible to municipal waste collection services due to narrow streets and alleys. This often leads to improper waste disposal, including non-segregation and dumping in waterways. To address this, a community-based solid waste management sub-system (CBSWMS) was demonstrated in 78 selected barangays across Manila, Pasay, Taguig, Pasig, and Pateros, utilizing the Act-Learn principle. The CBSWMS comprised three core components: (1) establishing a community-led SWM sub-system in inaccessible areas, facilitated by Women's Groups (WGs) as barangay SWM partners; (2) implementing a three-tiered sub-system promoting waste segregation and diversion before final disposal; and (3) providing enabling mechanisms for effective implementation. Demonstration results indicate that sustainability mechanisms for WGs, including diverse income sources and gender-mainstreaming strategies, are crucial. Furthermore, an increased focus on segregation-at-source and adequate SWM resources (tools, equipment, and dedicated sorting/recovery spaces) are vital for the sub-system's success and for increasing waste diversion rates.

## 1. Introduction

Since the enactment of Republic Act (RA) 9003, the Ecological Solid Waste Management Act of 2000, the Philippines has aimed to improve its solid waste management (SWM) through a systematic, comprehensive, and ecological approach [1]. RA 9003 delineates responsibilities across various government levels, from national agencies down to the barangays, the smallest local government units [1].

Metro Manila, the nation's capital, consists of 16 cities, 1 municipality, and 1,710 barangays [2]. The Metropolitan Manila Development Authority (MMDA) oversees the regional SWM board. While cities and municipalities contract private haulers for waste collection, RA 9003 mandates barangays to ensure 100% collection efficiency. However, narrow alleys in many areas hinder access for standard garbage trucks, compromising system efficiency [3, 4]. Communities in these inaccessible areas often resort to leaving unsegregated waste at undesignated points or disposing of it in waterways [5, 6]. These practices may be exacerbated by the centralized nature of waste collection and limited community involvement [7].

To address these challenges, a CBSWMS was conceptualized and demonstrated in 78 selected barangays in Metro Manila. This initiative aimed to improve waste collection services in inaccessible areas, promote waste

segregation and diversion, and empower local communities by fostering active participation and establishing a decentralized, local-level waste management framework.

## 2. Methodology

The demonstration of the CBSWMS involved 78 barangays in the Cities of Manila, Pasay, Pasig, Taguig, and the Municipality of Pateros. These barangays were selected based on the presence of areas inaccessible to standard garbage trucks and varied in population and land area.

Existing LGU-contracted garbage truck routes were analyzed to identify inaccessible streets [8-12]. Site visits and consultations with barangay councils helped identify narrow alleyways not visible on standard maps. The number of households in these inaccessible communities was then determined.

To facilitate the demonstration of a CBSWMS, the study identified three primary components: (1) key actors from the community who will implement the system; (2) the design and structure of the solid waste management sub-system; and (3) enabling mechanisms to ensure the system is implemented effectively and efficiently. The Act-Learn principle is fundamental to the development of the CBSWMS, emphasizing the significance of action in the learning process required to refine the sub-system. In this context, "Act" refers to the phase in which individuals actively engage in a task or experience, while "Learn" pertains to the reflection and analysis of those experiences to extract insights for improvement. In this study, the demonstration of the CBSWMS occurs during the "Act" phase. The conceptualized components for this phase are as follows:

### 2.1 The SWM Community Leaders

The CBSWMS empowers the community through the Barangay Ecological Solid Waste Management Committee (BESWMC), which is responsible for developing community waste management programs. This study focused on mobilizing Women’s Groups (WGs) as barangay SWM partners, recognizing their significant role in local SWM initiatives [13, 14]. WGs were formally organized and trained to operate as SWM enterprises, aiming for income generation and sustainability

### 2.2 The Sub-System

The CBSWMS features a three-level household waste management approach (Fig. 1). The first level focuses on Waste Segregation at Source, where inaccessible communities are trained by the BESWMC and WG to categorize their waste into three types: Biodegradables, Recyclables, and Residual Wastes. This training aims to encourage proper waste segregation practices. The second level involves Waste Sorting and Recovery, in which the WGs conduct final sorting and recovery of the collected waste from the households. The third level comprises Waste Diversion and Final Disposal. At this stage, waste is either diverted for community composting within the barangay or sold to junk shops, providing income for the WGs. Any residual waste that cannot be processed is handed over to locally contracted garbage trucks for final disposal in landfills.

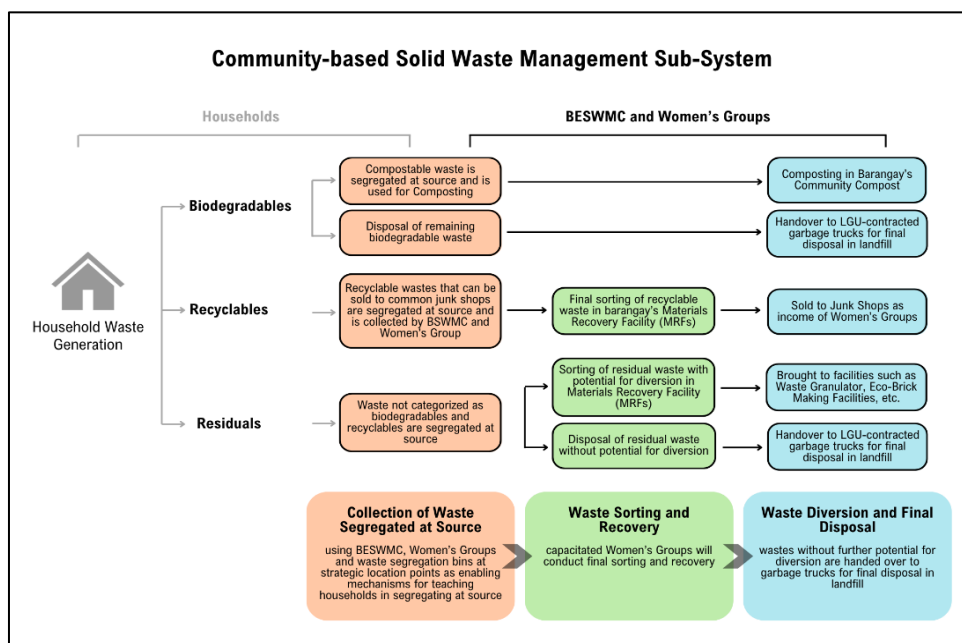


Fig. 1 Community-based solid waste management sub-system flow chart

## 2.3 The Enabling Mechanisms

To support CBSWMS demonstration; (1) Facilitation of capacity building activities to BESWMCs and WGs such as but not limited to; (1.a) review of the salient points of RA 9003, (1.b) review of the stipulated roles of the barangay and the community in solid waste management as stated in RA 9003, (1.c) proper waste segregation practices, (1.d) waste diversion techniques, and (1.e) waste diversion schemes as potential source of income of the WGs; (2) Facilitation of planning workshop involving the barangay council and the formed WGs to develop a scheme for the sub-system that aligns with their barangay's geographic and demographic characteristics as well as the existing solid waste management conditions; and (3) Provision of essential SWM tools and equipment.

Each barangay was provided with buggy carts for door-to-door waste collection, along with one small waste transport vehicle with bins, commonly referred to as a "chariot," specifically designed to navigate the narrow alleys in hard-to-access areas. Additionally, other necessary SWM tools, such as brooms and rakes, were included. Fig. 2 illustrates a sample CBSWMS route (blue arrows) complementing existing LGU collection routes (black arrows) in Barangay 826, Manila.

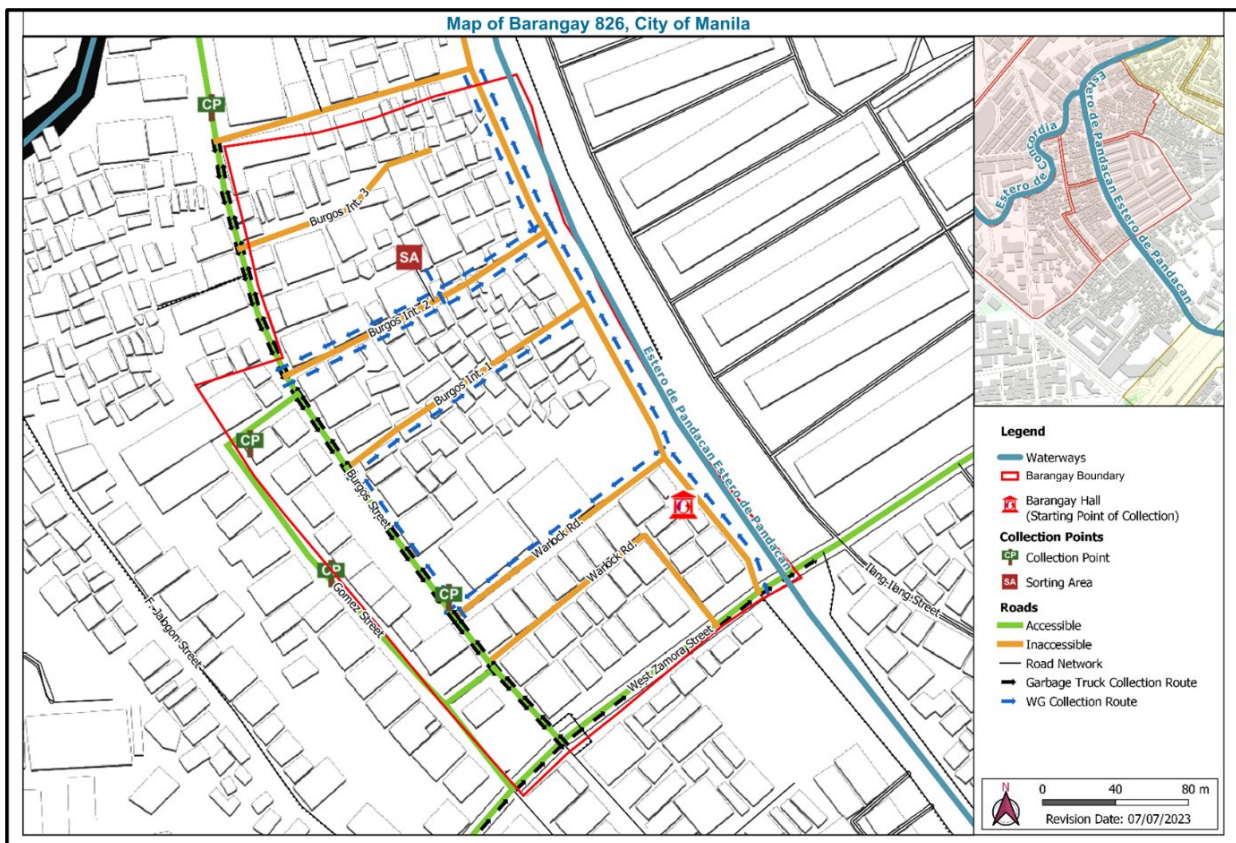


Fig. 2 The CBSWMS route scheme in Barangay 826, City of Manila

## 2.4 The Monitoring Tool

A CBSWMS monitoring tool (in the form of logbook) was developed for BESWMCs and WGs to track segregated, collected, and diverted waste (Biodegradables for Compost, Disposed Biodegradables, Recyclables Sold, Residual Waste for Further Diversion, Disposed Residual Waste). This allowed monitoring of waste volumes for composting, sale, diversion, and landfill disposal.

## 3. Results and Discussion

The CBSWMS was demonstrated over a three-month period. Below are the results for each activity conducted as part of the proposed sub-system:

### 3.1 Formed Women's Groups as SWM Partner of Barangays

A total of 24 WGs were established across the sample barangays, with 10 to 30 members each (women street sweepers, mothers, community leaders). Of 78 barangays, 76 participated in WG formation, and 61 actively implemented the CBSWMS (Table 1).

**Table 1** Formed women's groups per LGU

LGU	Women's Group	Number of Barangays within the Group	Number of Barangays that Operated the CBSWMS
Manila	Zone 4 Canal Women's Association	4	3 out of 4
	Zone 5 Dela Reyna Women's Association	5	4 out of 5
	Amazona Women's Association	3	all 3
	Velasquez Women's Association	4	3 out of 4
	Capulong Women's Association	4	1 out of 4
	Isla de Balut Women's Association	6	all 6
	Cristala Women's Association	3	all 3
	CDZ Women's Association	3	2 out of 3
	Pedro Gil Women's Association	4	2 out of 4
	Gomburza Women's Empowerment Association	3	all 3
	MBS Women's Association	3	all 3
Pasay	Riverside Women's Association	2	all 2
	Women's Troopers Association	3	all 3
	Tripa de Gallina Women's Association	3	all 3
	New Maricaban Women's Empowerment Association	4	3 out of 4
	Women's Green Nature Association	5	4 out of 5
	Women Pink Posse Association	4	all 4
	Kababaihan para sa Kalikasan	5	4 out of 5
Don Carlos Mariposa Women's Association	3	2 out of 3	
Pasig	Kababaihan para sa Kalinisan	1	1 out of 1
Taguig	Samahan ng Kababaihan ng Napindan	1	1 out of 1
	Samahan ng Kababaihan ng Palingon	1	not yet operational
Pateros	Barangay Sta. Ana Solo Parent Association	1	not yet operational
	SRK Association	1	not yet operational
Total		76	61

### 3.2 CBSWMS Collection Results

The CBSWMS schemes improved accessibility to previously unreachable areas through door-to-door collection, designated collection points, and the use of provided SWM tools. Table 2 shows the percentage distribution of inaccessible communities covered. A significant portion of the population in these communities remained uncovered.

**Table 2** Percentage distribution of inaccessible communities covered by the CBSWMS

LGU	Inaccessible communities not covered by the sub-system		Inaccessible communities covered by the sub-system			Total Coverage of Sub-system
	Households that practice leaving garbage at the curbside to be collected by garbage truck	Collected by Informal Waste Collectors	Door-to-door collection	Collected by BESWMC	Collected by WGs	
Manila	55.99%	4.28%	8.45%	17.15%	13.49%	39.09%
Pasay	45.27%	8.97%	6.56%	9.41%	25.61%	41.58%
Pasig	78.14%	0.00%	0.00%	0.00%	21.86%	21.86%
Taguig	78.10%	0.00%	0.00%	0.33%	21.57%	21.90%
Pateros	69.66%	0.00%	0.00%	0.00%	30.34%	30.34%

Door-to-door collection coverage was higher in Manila (17.15%) compared to Pasay (9.41%), Pasig (0%), Taguig (0.33%), and Pateros (0%). This variation is linked to population density, barangay size, and the number of WG members. Smaller barangays in Manila saw better coverage by WGs. In larger barangays (Pasay, Pasig, Taguig, Pateros), designated collection points compensated for limited WG capacity, resulting in collection coverage of 25.61% (Pasay), 21.86% (Pasig), 21.57% (Taguig), and 30.34% (Pateros).

Additionally, the study identified informal waste collectors, commonly known as "waste pickers," operating in these inaccessible communities of Manila (4.28%) and Pasay (8.97%). These waste pickers are recommended for inclusion in a formalized SWM group, as they are already engaged in waste collection. However, it should be noted that many of these informal waste collectors experience psychological or psychosocial disabilities, which may complicate efforts to formalize their participation. Addressing these complexities is crucial to ensure that their rights, needs, and capacities are respected and supported [15].

### 3.3 CBSWMS Segregation, Sorting, and Diversion Results

To assess the outcomes of the implemented segregation and diversion efforts under the proposed CBSWMS, the monitoring tools provided to the BESWMCs and WGs were compiled. Table 3 presents the results of the segregation and diversion initiatives carried out in hard-to-reach communities.

**Table 3** Percentage of collected, diverted, and disposed waste in inaccessible communities

LGU	Biodegradables Composted	Biodegradables Disposed	Recyclables Diverted	Residual Waste Diverted	Residual Waste Disposed	Total Collected
Manila	0.02%	3.53%	5.22%	0.07%	91.16%	100.00%
Pasay	0.00%	4.02%	1.23%	0.00%	94.75%	100.00%
Pasig	0.00%	0.00%	0.00%	0.00%	100.00%	100.00%
Taguig	0.00%	0.00%	6.41%	0.00%	93.59%	100.00%
Pateros	0.00%	0.00%	0.13%	0.00%	99.87%	100.00%

The results reveal a significant disparity between disposed and diverted waste volumes, indicating that much biodegradable and residual waste was mixed with recyclables, rendering them unsuitable for diversion. BESWMCs and WGs faced challenges in secondary sorting and recovery due to a lack of Materials Recovery Facilities (MRFs) and limited sorting space [16].

Taguig showed the highest recyclable waste diversion, attributed to available MRFs and larger sorting areas due to its geographic size. Manila had the second-highest rate, likely due to numerous junk shops [17]. The results underscore insufficient waste segregation at source, leading to unsorted waste going to landfills.

### 3.4 Other Results

WGs struggled with consistent door-to-door collection due to limited income from waste diversion, leading to reduced participation in WGs and consequently lower collection coverage. The CBSWMS also added to the time burden of women, affecting their primary caregiving roles, and contributed to a social stigma associated with SWM work compared to white-collar professions [18].

### 3.5 Gaps and Challenges Encountered

The three-month demonstration of the CBSWMS highlighted several critical factors influencing its effectiveness and sustainability.

The reliance of WGs on income solely from waste management activities proved insufficient for daily operational sustainability. This financial constraint, coupled with the increased time burden and social stigma, impacted WG member retention and motivation, ultimately affecting collection efficiency. This underscores the need for diversified and stable income sources beyond the sale of recyclables.

Collection coverage varied significantly, with smaller, denser barangays (like those in Manila) showing better door-to-door reach by WGs. In larger barangays, the strategy of designated collection points proved more effective but still left a substantial portion of inaccessible communities unserved. This points to the necessity of tailoring the number and capacity of WGs to the specific geographic and demographic characteristics of each barangay.

A major challenge was the low rate of waste diversion, primarily attributed to insufficient segregation at the source by households [19, 20]. This lack of initial segregation rendered much of the collected waste unsuitable for recovery, increasing the workload for WGs during secondary sorting and diminishing the potential for income generation. The absence of adequate MRFs and dedicated sorting spaces in most barangays further compounded this issue, limiting the capacity for effective waste recovery [16]. While Taguig's relative success in diversion highlights the importance of such infrastructure, the general lack across other LGUs remains a significant barrier.

The provision of SWM tools and equipment was beneficial, but the quantity was often inadequate for the scale of operations, particularly in larger barangays like those in Taguig, Pasig, and Pateros, where a single "chariot" was insufficient.

The identification of informal waste collectors presents an opportunity for integration into the formal SWM system. However, addressing their specific needs, including potential psychosocial disabilities, is crucial for successful and ethical formalization [15].

The Act-Learn principle embedded in the study's design allowed for the identification of these gaps. The findings suggest that while the CBSWMS model has potential, its optimization requires addressing these multifaceted challenges related to financial sustainability, operational scale, community participation (especially in segregation), infrastructure, and social dimensions.

## 4. Conclusion and Recommendations

To enhance SWM in inaccessible communities and reduce indiscriminate waste disposal, a refined community-based, decentralized SWM sub-system must be developed with key considerations for sustainability and efficiency [21].

Ensuring the long-term viability of WGs is central to this approach. This includes formal recognition by city/municipal LGUs (e.g., as official SWM unit, access to local development funds) and comprehensive capacity building focusing on decision-making, resource acquisition, and organizational management, employing an inclusive, gender-mainstreaming approach.

Effective waste collection requires assessing the optimal number and capacity of WGs to adequately serve high-density barangays. Matching service coverage to local settlement patterns enhances operational reach and community engagement.

Waste segregation at source must be strengthened through targeted education, incentive schemes, and the provision of communal segregation bins. Source-level sorting reduces recovery costs and increases the efficiency of downstream processing.

Infrastructure support—such as tools, composting areas, and MRFs—is essential. LGU-backed investment in separate collection systems for biodegradable and non-biodegradable waste further supports system functionality.

The insights from this demonstration, guided by the Act-Learn framework, will inform the refinement and future implementation phases of the CBSWMS, aiming for a more effective and sustainable solution to waste management challenges in Metro Manila's inaccessible communities.

## Acknowledgement

The authors express their gratitude to the Metropolitan Manila Development Authority (MMDA) for their Planning and Demonstration of the Community-based Solid Waste Management Project, which includes the Demonstration of Community-based Solid Waste Management Sub-System as one of the strategies executed by Woodfields Consultants, Inc. (WCI).

## Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of the paper.

## Author Contribution

The authors confirm contribution to the paper as follows: **study conception and design:** Guinevere S. Constantino, Dr. Reynaldo R. Medina, Dr. Kristine Ann M. Luna, Anne Louise T. Toleza; **data collection:** Guinevere S. Constantino; **analysis and interpretation of results:** Guinevere S. Constantino, Dr. Reynaldo R. Medina, Dr. Kristine Ann M. Luna; **draft manuscript preparation:** Guinevere S. Constantino, Dr. Reynaldo R. Medina, Dr. Kristine Ann M. Luna, Anne Louise T. Toleza. All authors reviewed the results and approved the final version of the manuscript.

## References

- [1] Ecological Solid Waste Management Act. (2000). Retrieved from <https://www.officialgazette.gov.ph/2001/01/26/republic-act-no-9003/>
- [2] National Capital Region (NCR) Profile – PhilAtlas. (2020). Retrieved from <https://www.philatlas.com/luzon/ncr.html>
- [3] World Bank. (2022). An Assessment of Municipal Solid Waste Plans, Collection, Recycling and Disposal of Metro Manila. Washington DC
- [4] Bernardo, E. (2008). Solid - Waste Management Practices of Households in Manila, Philippines. *Annals of the New York Academy of Sciences*. 1140. 420-4. 10.1196/annals.1454.016.
- [5] Reyes, M. (2023, February 4). Worsening garbage problem. *Philstar.com*. <https://www.philstar.com/business/2023/02/04/2242354/worsening-garbage-problem>
- [6] Arranza, J. L. (2024, July 31). Flooding in Metro Manila: The urgent need to review government's waste management shortcomings. *Business Mirror*. <https://businessmirror.com.ph/2024/07/31/flooding-in-metro-manila-the-urgent-need-to-review-governments-waste-management-shortcomings/>
- [7] Sinthumule, I. & Mkumbuzi, S. (2019). Participation in Community-Based Solid Waste Management in Nkulumane Suburb, Bulawayo, Zimbabwe. *Resources*. 8. 30. 10.3390/resources8010030.
- [8] City of Manila, Department of Public Services. (2015). 10-Year Solid Waste Management Plan (2015-2025).
- [9] Municipality of Pateros. (2019). 10-Year Solid Waste Management Plan (2019-2028).
- [10] Pasay City. (2015). Pasay City 10-Year Solid Waste Management Plan (2015-2025).
- [11] Pasig City. (2015). Pasig City Ten-Year Solid Waste Management Plan (2015-2024).
- [12] Taguig City. (2015). The City Government of Taguig, 10 Year Solid Waste Management Plan (2015-2024)
- [13] Noviani, E. (2023, June 26). *Philippine NGO trains women to operate a recycling centre*. RKC | MPD. <https://legacy.rkcmpd-eria.org/cora-eco-ikot-women-empowerment-and-community-based-recycling-system/>
- [14] Serrona, K. R. B., & Yu, J. (2008). Women-led Community-based Plastic Recycling in Metro Manila, Philippines: A Case Study of KILUS Multi-purpose Cooperative. *Japan Science Technology Information Aggregator, Electronic*, 19, 302. <https://doi.org/10.14912/jswmepac.19.0.302.0>
- [15] Mori, S., Reyes, C. M., & Yamagata, T. (2017). Poverty reduction of the disabled: Livelihood of Persons with Disabilities in the Philippines (1st ed.). Routledge.
- [16] Santos, J. (2024, February 22). *Philippines lacks recycling infrastructure—DENR*. Manila Bulletin. <https://mb.com.ph/2024/2/22/philippines-lacks-recycling-infrastructure-denr>
- [17] National Solid Waste Management Commission. (2023). Inventory of Junk Shops and Recycling Facilities per Region (as of December 2023). Retrieved from <https://nswmc.emb.gov.ph/wp-content/uploads/2024/11/Junk-Shops-and-Recycling-Facilities-.pdf>
- [18] Enano, J. O. (2023, October 29). In informal waste work, women are twice as vulnerable, invisible. *RAPPLER*. <https://www.rappler.com/environment/informal-waste-work-women-twice-vulnerable-invisible/>
- [19] Agoot, L. (2022, December 10). More waste segregation efforts pushed to cut costs by 65%. *Philippine News Agency*. <https://www.pna.gov.ph/index.php/articles/1221049>
- [20] EcoWaste Coalition. (2009, September 16). EcoWaste Coalition backs mandatory waste separation. Retrieved from <https://www.ecowastecoalition.org/ecowaste-coalition-backs-mandatory/>
- [21] Asia-Pacific, I. (2025, January 15). Philippines' zero-waste bid relies on informal workers. *Eco-Business*. <https://www.eco-business.com/news/philippines-zero-waste-bid-relies-on-informal-workers/>