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REDUCING PLASTIC POLLUTION IN THE ASEAN REGION (ASEANO) 2020 – 2021

SUBPROJECT 3:

SOCIAL IMPLICATIONS OF PLASTIC POLLUTION MITIGATION INITIATIVES NEAR THE IMUS RIVER: BASIS FOR POLICY FRAMEWORK

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Executive Summary

This study investigates the socioeconomic implications of plastic waste pollution mitigation initiatives near the Imus River, which traverses through the province of Cavite. It explores initiatives identified by the communities on plastic waste management and consequently examines how these initiatives are managed and implemented. It also describes the communities' culturally nuanced understanding of plastic waste management, as well as the implications of such management to Cavite residents.

This study forms part of several research projects that seek to understand the status, nature, extent, and effect of plastic pollution along the Imus River, which empties into Manila Bay. The findings of this study attempt to substantiate the waste pollution monitoring mechanisms informed by local understanding and experience.

The data is gathered from five sites traversed by the Imus River, in selected barangays in (upstream to downstream) Silang, Dasmariñas, Imus, Bacoor, and Kawit. The methods used were concurrent triangulation of quantitative and qualitative data, a survey of 300 residents, and in-depth interviews of 20 key informants from different sectors in the community. Other sources of data, i.e., local documents, online and on-site focus group discussions (FGDs), and direct observations complemented the survey results.

Results show that residents are cognizant of their role in the worsening problem of plastic pollution, and are willing to participate in worthwhile initiatives to address the problem. Residents single out the regular and proper waste collection as the most important measure to curb plastic waste pollution, while local government officials stated varied programs, mostly on reuse and recycling, were the best initiatives.

Most plastics used in households are in sachets for retailed fast-moving products (tingi) from sundry stores (sari-sari) ubiquitous in the neighborhood. These retail products are generally purchased for their premium quality at a cheap upfront cost.

The residents' knowledge of initiatives aimed at addressing plastic pollution and waste leakage to the river is limited to awareness of regular clean-up drives. This is

despite other initiatives being implemented, which were uncovered during key informant interviews and FGDs. Further research into these initiatives yielded three exemplary programs: War on Waste (Bacoor), BasuRaffle (Imus), and Waste to Ecobricks Technology (Silang). A cost-benefit analysis was done for these initiatives using Private Benefit (BP) and Total Benefit (BT) derived from their operations.

Plastic waste mitigation efforts are perceived to likely result in less income for waste pickers who earn from collecting recyclable plastics, to increase the difficulty of packaging goods from the wet market, and to increase budget constraints for people with meager incomes. In general, laws are in place to mitigate plastic waste and to regulate its use and disposal, but these are not effectively implemented.

As such, political will remains a key factor in plastic management for both national and local chief executives. It is imperative that barangays, as grassroots implementors of policies affecting households, are consulted and supported by their respective city or municipal governments, in waste management implementation.

Policy and implementation should be geared at engaging all actors (producers, retailers, consumers) at every state in the plastic chain (collection, co-processing). The role of government at national and local levels, and the engagement of civil society, are both key to this. The central factor is *people*, whose actions can lessen or exacerbate pollution, and hence, any initiative must be adapted to the situation of a local community.

This study hopes that policymakers and project managers of pollution mitigation initiatives consider how people understand plastic pollution and its implications to society. This information intends to prompt appropriate responses that are sensitive to local communities while addressing their intended outcome. The study recommends that plastic waste management initiatives recognize how different actors contribute to address and mitigate plastic pollution in the Imus River.



Introduction

Schmidt, Krauth, and Wagner (2017) suggest that most ocean pollution come from rivers, including not only uncollected waste but leakage from already collected items. In an estimate made by the WWF-Philippines, the National Solid Waste Management Commission, and the World Bank, about 74% of plastic pollution in the Philippines comes from collected wastes (WWF, 2018).

The Imus River flow into Manila Bay, likely contributing to plastic pollution in the area. As such, there are several initiatives that aim to address plastic pollution in the region, as well as elsewhere in Cavite and other provinces surrounding the bay.

Purpose of the Report

This report draws from recent initiatives addressing plastic pollution in the Imus River. It investigates the consequences of these initiatives for the lives of the public, as well providing analysis of the decisions arrived at in the management and implementation of the said initiatives. The report intends to enhance the understanding of best practices towards the goal of curbing plastic pollution at the least possible cost.

The overarching goal is to assess the social implications of plastic pollution mitigation initiatives near the Imus River. In particular, the following are the specific objectives: 1) to identify the initiatives and best practices for plastic waste management, 2) to analyze the management and implementation of initiatives for plastic waste management; 3) to evaluate the cost and benefit of plastic waste management and initiatives; 4) to identify potential secondary effects of plastic waste management measures, and 5) to describe the local meaning-making of plastic waste management.

This report sets out how local communities regard the use of plastics in mundane life and where these go after their use. It also highlights how local communities perceived plastic waste pollution and the best initiatives to address it, keeping in

mind local meaning-making. In addition, the report identifies the initiatives beyond the perception of the communities, and assesses their effectiveness.

Intended Audience

It is hoped that the report shall be a reference for the local or national policymakers and the project managers of waste management initiatives, in addition to those who are working in non-government organizations whose interests lie in the efficient and effective management and implementation of plastic pollution initiatives.

Setting the Scene

Plastics have pervaded all dimensions of human life. They have revolutionized medical equipment, reduced the weight of vehicles, made furniture and appliances affordable, made gadgets lightweight, preserved food, enabled delivery of clean drinking water, and enclosed food among others. The prospective utility of plastics can only be described as boundless.

Plastics are versatile, cost-effective, and lighter than alternative materials; they also require less energy to produce and can be manufactured to have many different properties. These qualities make them an ideal material for single-use disposable materials.

However, the detrimental effects of plastics have also been unprecedented. Plastics pollute water, soil, and air with toxins, create underground cavities that collapse into sinkholes, and raise pressure in underground rock formations, which can destabilize them and can potentially cause earthquakes (Peplow, 2017). Furthermore, microplastics contaminate air, water, food, and drinks. All types of sea creatures are ingesting microplastics, and as they move up the food chain, these plastics inevitably end up in the human gut. Microplastics act like magnets for a range of other poisons and pollutants spilled into the natural world, i.e., organic materials, pesticides, and pharmaceuticals, which end up in our marine systems and tend to concentrate on these tiny plastic particles that potentially disturb our body system (ImpactHub, 2019).

An increase in human population amplifies the demand for plastics, consequently increasing production which in turn intensifies the generation of plastic waste and its ensuing environmental pollution. Globally, plastic production was estimated to be 380 million tons in 2018. From 1950 to 2018, about 6.3 billion tons have been

produced worldwide (Ritchie & Roser, 2019). Jambeck, Geyer, Wilcox, Siegler, Perryman, Andrady, Narayan, and Law (2015) reported that China, Indonesia, Philippines, Thailand, and Vietnam generate more marine plastic pollution than the rest of the world combined.

In the Philippines, the average Filipino uses 591 pieces of sachets, 174 shopping bags, and 163 plastic “labo” (single-use plastic) bags annually. Almost 48 million shopping bags are used throughout the Philippines every day, or roughly 17.5 billion pieces a year. This is in addition to 45.2 million plastic “labo” bags per day, or 16.5 billion pieces a year. Around three million diapers are discarded in the Philippines daily, or 1.1 billion diapers annually (GAIA, 2019). These figures show the sheer volume of residual waste generated in the Philippines.

Ecological damages from the said wastes have been well documented and have spurred strong sentiments from many advocacy groups. Likewise, the economic and social costs, such as a decrease in food sources due to drop in production of marine resources, declines in tourism and concomitant loss of jobs, health impacts, and the costs of clean-up, among others, are further impetus for both government and non-government entities to work together and strengthen policies to mitigate those adverse effects.

Overview and Objectives

Abe and Didham (2007) propose that both central and local governments, environmental non-governmental organizations (NGOs), entrepreneurs, mass-media, among others, all influence public awareness through their policies, practices, and operations, which lead to “capacity development”. Regardless, the global problem of how to manage waste has plagued governments and private entities despite well-crafted strategies, policies, or programs.

On the part of the Philippine legislature, laws governing pollution and waste management are in place (i.e., RA 9003, RA 6789, ordinances), yet implementation is wanting and even contentious for many valid reasons. There are gaps in how the policies are operationalized into projects and activities. That policies influence public awareness leading in turn to exemplary waste disposal practices is a complex matter. Policies could work although long-term effects are often uncertain (Heidbreder, Bablok, Drews, & Menzel, 2019). For example, a study in Northern Philippines, reported that certain factors, namely age and municipality, are linked with dumping solid waste in public areas as compared to dropping it off at designated locations via ordinances (Crowley, 2017). The same study concluded that composting solid waste

compared to dropping it off at designated locations are all predictors of weekly plastic bag consumption. Apart from policies dictating practice, an extensive review of perceptions, behaviors and interventions found that people's habits, norms, and situational factors are also predictive factors (Heidbreder, *et al.*, 2019). Furthermore, other factors crucial in proper waste management pointed to gender and educational attainment (Felisilda, Asequia, Encarguez, & Galarpe, 2018), higher level of awareness/knowledge of waste management especially the dangers of landfill use (Afroz, Rahman, Masud, & Akhtar, 2017) and subjective norms including convenience (Khan, Ahmed, & Najmi, 2019).

It is sometimes contended that while banning single-use plastic may reduce the most visible form of plastic pollution, it could be at the expense of exacerbating other environmental impacts. Disposable plastic bags require fewer resources (land, water, CO₂ emissions, etc.) to produce than paper, cotton, or reusable plastic bags—by a wide margin (Bell & Cave, 2011). Moreover, small enterprises may bear the brunt of these prohibitions, as anecdotal evidence shows that more and more people live on trash via the establishment of junk shops and recycling facilities. It is likewise important to note that the recognized “tingi” (retail) culture among Filipinos preponderantly favors products sold in sachets over bulk, and hence, the problem of plastic waste management must be culturally informed. In short, there is more to policy than just the issue of plastics as society, culture, and the concomitant implications play in more a quotidian practice of management and resolution of plastic waste pollution.

Against this backdrop, a thorough investigation could aid current efforts of institutions advocating for plastic waste management.

The present study is a partnership between De La Salle University-Dasmariñas (DLSU-D) and Partnerships in Environmental Management for the Seas of East Asia (PEMSEA). Banking on the research capability of DLSU-D, the present study endeavors to look at the social implications of plastic pollution mitigation initiatives along the Imus River, spanning several cities and municipalities of the province of Cavite.

Analytical Framework

The framework of the study (Figure 1) is intended to capture the voice of local people (mindful of the importance of considering representation by gender and status of residents) as their views are considered of similar importance with that of policymakers and project implementers coming from various sectors.

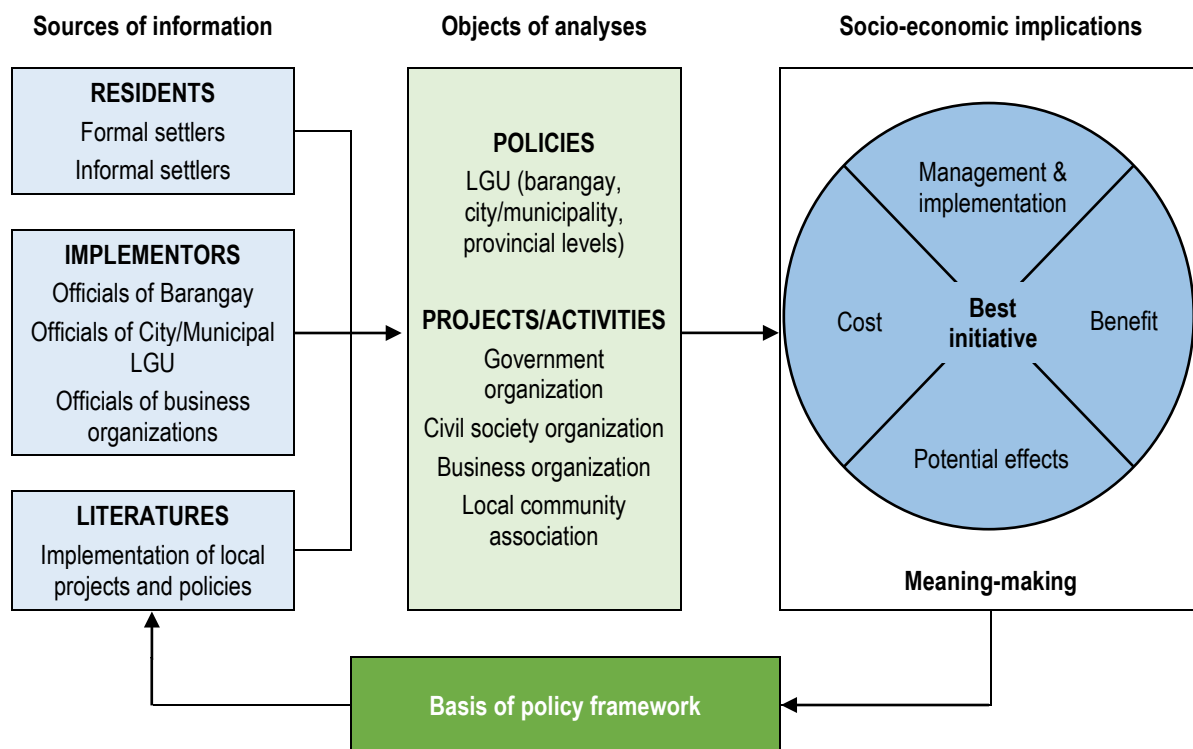


Figure 1. Analytical framework of the study

The call for academics to consider the voice of the local communities in research is of prime importance (Bergold & Thomas, 2012). In recognition of how integral the locals are, this research intends to collaborate with communities from all stages in the research, i.e., crafting instruments, pursuing research questions, data gathering, writing the outcomes, and formulating recommendations. Doing these empower people to articulate, justify, and assert their views in ownership of the communitarian concern on plastic waste pollution. More importantly, when people consider themselves stakeholders, activities for the sustainability of projects are more enhanced (Jagosh, Macaulay, Pluye, Salsberg, Bush, Henderson, & Greenhalgh, 2012).

On these grounds, the study attempts to exact information from diverse sources of information not limited to documents nor the policymakers and the implementers but more so on the grassroots like the residents and the settlers (cf. sources of information). The end is to investigate the policies of the localities as well as their projects and initiatives in relation to the management of plastic wastes (cf. objects of analyses). In the end, the study seeks to identify the best practices (cf. socio-economic implications) in addressing the issue, their management and implementation, their corresponding cost and benefit, and their possible secondary implications to society by and large. In the process, the study explores into the local meaning-making of people and communities on the policy and practice of plastic waste management along the Imus River.

Acknowledging that in surveys, people's perception may result to under reporting or over reporting (i.e., respondents tend to report more socially desired behaviors than they performed or understate that they have engaged in socially undesirable behaviors) (Lavrakas, 2008), triangulation is applied using extensive document review, key informant interviews and observation of sites.

In the end a culturally sensitive policy framework will be crafted informed by information gathered from surveys, KIs, documents and reports, and observation of research sites. The same framework shall add to existing literature that can be utilized by policymakers, implementers, residents, and all stakeholders in general.

Scope and Limitation

The study purposely did not dwell on the efficiency of collection of plastic waste as it is assumed to be low, judging from the ocular visits to several barangays the Imus River traverses. Further, focusing on efficiency places the research in bureaucratic directive, rather than participative, which often repulse policymakers and alarms residents, as Filipino culture strongly cultivates smooth interpersonal relationships through euphemisms. Aiming at best practices and implementation of policies is political posturing banking on local knowledge and participation to address the collective problem. This study shall attempt to offer a framework for understanding plastic waste management as a lobbying tool for information and policymaking.

The primary goal of this study is to present a holistic picture of the initiatives to curb plastic pollution of the Imus River by investigating on the social implications. Social in this case is used as an all-encompassing concept to incorporate the economic, political, and cultural dimensions of mitigation initiatives.

Initiatives are operationalized to mean two things that addressed plastic pollution along the Imus River – first, projects of both government and non-government entities, and second, policies at the provincial, municipal/city, and barangay levels. These initiatives shall be examined through various methods: document study, survey, key informant interviews, and observations.

Since certain criteria must be met for people to be considered as respondents, purposive and, alternatively, convenience sampling shall be utilized. The use of these kinds of sampling is intentional as the study aims to get as much information from diverse sources, with presumably different responses and ideas, a rich source of data for the study.



Methodology

Overarching Principle

The present research follows the tenets of community community-based participatory research in recognition of the fact that although plastic waste pollution is a global problem, solutions to these common problems are frequently unique and specific to local cultures and histories (Cf. Ablah, Brown, Carroll, & Brownleewe, 2016 and Tremblay, Martin, McComber, McGregor, & Macaulay, 2018). It is the local people who overcome day-to-day challenges of community work and are immersed in the lives of the residents, and hence, have the best information to contribute to a project's success, not the academics who mostly have the least connection to the local, on-the-ground knowledge.

The inclusion of local people does not compromise the rigors demanded of scientific inquiry, but rather ensure that the research results both come from the people and go directly back to them who need them most and can make the best use of them. This participatory principle is reflected in the sampling methodology and in tool construction.

DLSU-D's social research track has shown its bias towards this participatory principle. In recent commissioned studies titled Joyville: Child and Community Development Program End-of-Term Evaluation (2019-2020), Integrated Community Development Program Baseline Report and Community Awareness and Recovery Project: An Evaluation (2017-2020), the participatory approach enabled the communities to become co-researchers in the process. Residents who have substantial knowledge of the research problems were selected as enumerators. Also, different sectors of the community were consulted in preparing and finalizing the tool to ensure that language and content is appropriate to the local culture. Finally, a presentation of initial research results was undertaken when after the survey was done where feedback and insights from the different sectors were solicited for validation purposes.

Research Design

The research follows the mixed methods approach, particularly, concurrent triangulation, which involves collecting qualitative and quantitative data at the same time. The purpose of such is to validate the findings generated by each method through evidence produced by the other. This method ensures the genuine “integration of the data at one or more stages in the process of research” (Creswell *et al.*, 2003, p. 212). This entails that in the different stages of the research, attempts to integrate both numerical and non-numerical data shall be facilitated.

The household survey produced mostly numerical data and minimally qualitative data in the last part, on “tingi”, the preponderance of Filipinos to buy in small quantities and its potential role in consumer behavior (see Ang & Sy-Changco, 2007). Conversely, the key informant interviews generated mostly qualitative information. Probing ensured that the “whys” and “hows” of the study were thoroughly investigated. Desk review of printed reports from all stakeholders provided validation to perceptions generated from surveys and KIs. Moreover, policy and project case analysis were ideal platforms for discussion on what key issues were and were not addressed leading to the present state of the Imus River.

Research Sites

The research sites, after the consequent ocular inspections along the stretch of the Imus River, were purposively chosen (Table 1) in a thorough discussion with the research team, based on the visits and initial focus group discussions and interviews with barangay captains, councilors, and other local officials (Cf. Teddlie & Yu, 2007 for an elaboration of the typology of purposive sampling strategies).

Sampling

A multistage sampling method was used in this study. The first stage was selecting the barangays. This was aided by interviews with other researchers who have done studies on the Imus River, and ocular visits along the entire stretch of the river. At this stage, purposeful or criterion sampling is used because specific criteria had to be fulfilled for the barangays to be chosen. The overarching aim is to include areas that have various cases of single plastic waste management: typical (Tanzang Luma 6, Imus), deviant (Tubuan 1, critical (Pulvorista, Kawit and Salinas 4, Bacoor), heterogeneous or maximum variation sampling (Sta. Fe, Dasmariñas).

Table 1. Research areas

City/ Municipality	Barangay*	Description
Kawit	Pulvorista	<ul style="list-style-type: none"> The river mouth where residual wastes, coming from upland areas of the Imus River, often settled (catch basin for residual wastes) Has current dredging and waterway unclogging initiatives, which make this area critical
Bacoor	Salinas 1	<ul style="list-style-type: none"> Local government has its own initiative to curb pollution and seems to have will to implement it, making this barangay critical as it could serve as model for proper waste management
Imus	Tanzang Luma 6	<ul style="list-style-type: none"> Large community of formal and informal settlers live near the Imus River and junk shops are ubiquitous Maybe viewed as typical of Philippine communities living near waterways
Dasmariñas	Sta. Fe	<ul style="list-style-type: none"> Big community in terms of population and the combined local and national flood control project traverses through this barangay. Residents of different demographic characteristics are included, and diverse views captured. Thus, making heterogeneity of perception possible.
Silang	Tubuan 1	<ul style="list-style-type: none"> The cleanliness of the Imus River passing through is set straight; contradictorily, coliform is present. Politics has riven local officials on the matter of garbage management (i.e., open dumpsite operation), which makes this barangay extreme/deviant

**These barangays, as research sites, are within 1 km radius from the streams of the river; though the Imus River watershed extends into the Municipality of Amadeo and the City of Tagaytay, these areas were deliberately excluded in the study because of negligible streams.*

The second stage entailed choosing the households. Again, purposive sampling used because this study assumes that households nearest to the river will have more information as to plastic waste management, and hence, the whole block was considered a cluster. The households belonging to the cluster served as possible respondents. Sampling with replacement was applied, and upon achieving the desired number of respondents, data collection ceased.

The third stage involved selecting the actual respondents in the identified household. The preference was for both the parents to be respondents to have a collective view, especially since most mothers in the Philippines are assigned the role of budgeting which make them the likely decision-makers about what to buy and since fathers may be more cognizant of the effects of plastic pollution due to their work especially those in the informal sector. Thus, at this stage, convenience sampling was used.

The sample size for the survey is pegged at 60 for each barangay in the five areas identified. As a rule of thumb, samples of at least 30 can be reasonably expected to have a valid analysis based upon normal distribution, i.e., it represents a threshold above which the sample size is no longer considered small (Rahman, 2017; cf. Sauro, 2013).

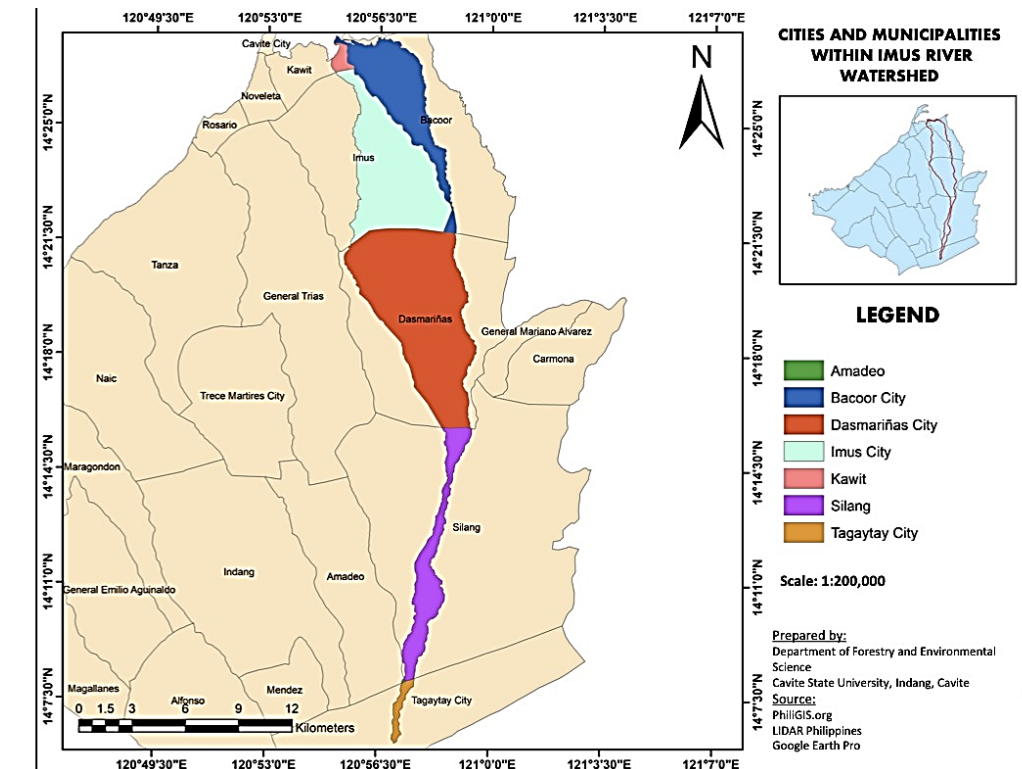


Figure 2. Map of the Imus River

Key Informants

The study assumes that the task of managing plastic waste falls under many different stakeholders. Hence, representatives from the different stakeholders were involved in the study. Purposive sampling was used as there is a set of criteria that must be fulfilled for them to be qualified as key informants. First, the person must either be (1) a local government official (barangay, municipality, city, province), (2) officials of civil society (people's organization (PO), faith-based organization (FBO) and other non-government organization (NGO) who have initiatives on plastic waste management, and (3) officials of business organizations (BO) whose businesses are within 5 km of the river.

The key informants, who were stakeholders deemed to possess information integral to plastic waste management, were interviewed (Table 2).

Table 2. Key informants

Key Informant	Designation	Sector
1. Anabelle Cayabyab	Provincial Government Environment and Natural Resources Office (PG-ENRO)	Local government
2. Merlina B. Cabrera	Municipal Government Environment and Natural Resources Office, Silang	Local government
3. Phoebe January Camaisa	Environmental Management Specialist, CENRO Imus	Local government
4. Doris Sagenes	City Government Environment and Natural Resources Office, Imus City	Local government
5. Alberto Nieto	City Environmental Sanitation Unit Head, Dasmariñas City	Local government
6. Emily Lamsen	Admin Aide/Asst. to Operations Head, MRF Silang	Local government
7. Herry Caballero	Operations Manager, MRF Silang	Local government
8. Ferdinand R. Garduque	Barangay Captain, Salinas 1, Bacoor	Local government
9. Jaime e. San Jose	Barangay Captain, Tanzang Luma, Imus	Local government
10. Domingo Ambita	Barangay Captain Tubuan 1, Silang	Local government
11. Noriel S. Gonzaga	Barangay Captain, Pulvorista, Kawit	Local government
12. Mamerto Buñag Noora, Jr.	Barangay Captain, Sta. Fe, Dasmariñas	Local government
13. Manager, name withheld	Jollibee Food Corporation	Business (fast food chain)
14. Rhodora Sacramento	Principal, Real Elementary School, Bacoor	Education
15. Lea	Homeowner officer	Organization
16. Married couple, names withheld	Junkshop proprietors	Local business
17. Mang Apolonio	Waste picker	Self-employed individual
18. Mang Roberto	Waste picker (differently abled)	Self-employed individual
19. Mang Kanor	Waste picker	Self-employed individual
20. Mr. and Mrs. Perez	Parents of elementary pupils	consumer

Data Collection Method and Tools

The themes reflected in the data gathering questions (Table 3) are intended to be comprehensiveness, towards the eventual goal of creating a policy framework.

Table 3. Matrix of objectives vis-a-vis method and tool

Problem	Data Collection Method	Themes of the Tool
1. To identify initiatives and best practices of plastic waste management	Key informant interviews, document study, survey	Evaluation of initiatives using the following criteria: relevance, effectiveness, efficiency, impact, sustainability
2. To analyze the management and implementation of initiatives on plastic waste management	Key informant interviews, document study, survey	Evaluation of implementation using the following key management factors: planning, organizing, staffing, directing, controlling
	Case analysis of pertinent policies, focus group discussion	Evaluation of policies using these criteria: efficiency, effectiveness, administrative feasibility, political feasibility, acceptability
3. To evaluate the cost and benefit of plastic waste management initiatives	Key informant interviews, document study, survey, case analysis of pertinent projects	Expenditures and benefits of various initiatives using valuation measures Intangible effects on people's lives
4. To identify potential secondary implications of plastic waste management initiatives	Key informant interviews, document study, survey	Secondary/indirect effects of waste management
5. To describe the local meaning-making of plastic waste management	Survey, key informant interviews, participant observation of relevant cases, such as owners of junk shops, informal settlers scavenging, etc.	Filipino cultural influences on perception, their own suggestions (cultural understanding)

The household survey produced mostly numerical data and minimally qualitative data, on “tingi” culture, the preponderance of Filipinos to buy in small quantities and its potential role in consumer behavior. The key informant interviews (KI) generated mostly qualitative information.

Data Management and Analysis

All information pertaining to the answers of the respondents are treated with utmost anonymity and confidentiality. No names of respondents are mentioned, unless integral to the study such as heads of LGUs, but only after permission is granted.

As a mixed method research, both quantitative and qualitative data were gathered. The numerical part of the survey (questions with rating scale) was tabulated to

produce descriptive statistics (mean, percentages, standard deviation, and other applicable statistical tools).

To analyze the qualitative data gathered in the study, the information collected from the respondents were clustered according to themes. This thematic analysis, in keeping with Braun and Clarke (2006) involves “identifying, analyzing, and reporting patterns (themes) within data” (p. 6). Relationships that emerged from the data were then identified.

All information were validated through member checking and triangulation. Member checking involved summarizing the interview transcript at the end of the interview and asking them to confirm if these are their perceptions. One of these is through community validation. Triangulation was undertaken by comparing several sources of data: transcripts, secondary data, and observation guide.

The triangulation of different sources ensured the validity of the study. The participatory nature emphasized in this study aims to add to its attempt at validity and better data analysis.

Ethical Considerations

The DLSU-D Ethics Review Committee (DERC) ensures that ethical considerations are vitally discussed before actual data gathering commences for every research.

The study made sure that informed consent was sought out before interviews and surveys were done. Upon getting the approval of the respondent to participate in the study, the goals of the project were explained and assurances of anonymity of identity anywhere in the write-up was guaranteed. The respondents were also told that anytime, during the data gathering, should they feel threatened or uncomfortable, they can opt to discontinue their participation.



Results and Discussion

BACKGROUND OF THE RESPONDENTS

Location of Respondents

A total of 300 respondents participated in the survey. Each of the five barangays were represented by 60 residents who generally live 83 meters from the Imus River (Table 4). Thus, their ability to observe the condition of the Imus River is evident when considering the proximity of their residences to it (Figure 3).

Table 4. Distance of residences from the Imus River

Distance (in meters)	Frequency	Percentage
100 and below	247	82.3
101-500	33	11.0
501 -1000	5	1.7
1001 and above	2	0.7
No response	13	4.3
<i>Mean – 82.93 meters</i>		



Figure 3. The location of the respondents *(Source: Google Earth)*



(cont.). The location of the respondents (Source: Google Earth)



(cont.). The location of the respondents (Source: Google Earth)

Demographic Characteristics

Table 5. Demographic characteristics of respondents

Demographic Characteristics	Frequency	Percentage
Gender		
Male	78	26
Female	213	71
LGBTQA+	9	3
Marital Status		
Married/Live in relationship	174	58
Single	94	31.3
Separated/Widowed	32	10.7
Age Group		
18-24	25	8.3
25-34	72	24.0
35-44	85	28.3
45-54	58	19.3
55-64	39	13.0
65 and above	18	6.0
No response	3	1.0
<i>Mean: 42 years</i>		
Highest Educational Attainment		
Elementary level/graduate	51	17.0
High School level/ graduate	178	59.3
Technical/Vocational	12	4.0
Non-formal education	11	3.7
College level/graduate	48	16.0
Household size		
1-2	33	11.0
3-4	106	35.3
5-6	110	36.7
7 and above	51	17.0
<i>Mean: 5 members</i>		
House Ownership		
Owned	187	62.3
Rented	84	28.0
Living w relatives/friends	29	9.7
Years of Residence in barangay		
1-10	98	32.7
11-20	56	18.7
21-30	69	23.0
31-40	49	16.3
41-50	13	4.3
51-60	10	3.3
61-70	5	1.7
<i>Mean: 22 years</i>		

In this study, more than two-thirds of the respondents are female (71%), more than half are married (58%), and belonging to the age range of 25-44 (\bar{x} = 42 years). In terms of educational attainment, majority reached or finished high school (59.3%), and a significant number (16%) are either college level or graduates. Likewise, two thirds belong to households with three to six members (\bar{x} =5). A majority owned the house they are living in (62.3%) while the rest are either renting or living with relatives. Almost half of the respondents have been living in the barangay for more than two decades (48.6%) while 18.7% have been residents for 11-20 years (Table 5).

A look at the employment data gathered from the survey (Table 6) indicate that almost all the respondents are working (95.7%). The job they are engaged in are diverse; vending (20.9%) and construction jobs top the list (23%) followed by factory/skilled work (15.3%) and office job (13.2%).

Table 6. Employment data

Employment Characteristics	Frequency	Percentage
Status		
Employed	253	84.33
Self-employed	34	18.11
No work	13	4.3
Category of work		
Construction work	66	23
Vending (sari-sari, market, delivery)	60	20.9
Factory work and other skill-based work	44	15.3
Office Staff/BPO	38	3.2
Small business owner/contractor	34	11.8
Barangay worker	10	3.5
OFW/Pensioner	9	3.1
Farming/fishing	9	3.1
Paid domestic work	7	2.4
Teaching	6	2.1
Management position	4	1.4
Income		
10,000 or below	169	56.3
10,001-20,000	62	20.7
20,001-30,000	22	7.3
30,001-40,000	7	2.3
40,001-50,000	2	0.7
50,001-60,000	2	0.7
No response/prefer not to say	36	12
<i>Mean: PHP 10,449</i>		
<i>Median: PHP 8,000</i>		

Most respondents are low wage earners, having a mean income of PHP10,449. When looking at the jobs of the respondents vis-à-vis their educational attainment, there appears to be a consistency: low education correlates with low-paying jobs.

MANAGEMENT AND IMPLEMENTATION

Environmental Policies

The local government units (LGU) of Cavite, divided into the province, cities, and municipalities, as well as barangays, have varying initiatives to curb plastic waste pollution. At the forefront of these initiatives are the environment and natural resources offices in those levels, i.e., the PG-ENRO, CENRO/MENRO. They are mandated as primary agencies for the conservation, management, development, and proper use of the environment and natural resources. Specifically, they are tasked to manage and implement policies, guidelines, rules, and regulations relating to the control and prevention of environmental pollution. A very important component is waste management and implementation, along with enabling laws that the local government units enact.

Policies in the Philippines that addressed the environment, e.g., plastic disposal, are usually embedded in laws passed either at national or local levels. These laws and ordinances provide a basis for local government units to wield power within their areas of jurisdiction.

National Level

Republic Act No. 9003 known as the “Ecological Solid Waste Management Act of 2000”

Environmental policies that primarily focused on the plastic pollution of rivers in the Philippines e.g., rivers in Cavite are vested in the local government units of the country. This mandate was strengthened with the passage of Republic Act No. 9003 known as the “Ecological Solid Waste Management Act of 2000” which directs the adoption of a systematic, comprehensive, and ecological solid waste management program to ensure the protection of public health and the environment. To effectively enforce the implementation of this Act, the responsibility of solid waste management is given to LGUs in close coordination with the national government, non-government organizations (NGO) and other private sectors.

RA 9003 likewise provides that LGUs are primarily responsible for the implementation and enforcement of the provisions of this Act within their respective jurisdictions. This includes segregation and collection of solid waste at the barangay level specifically for biodegradable, compostable and reusable wastes.

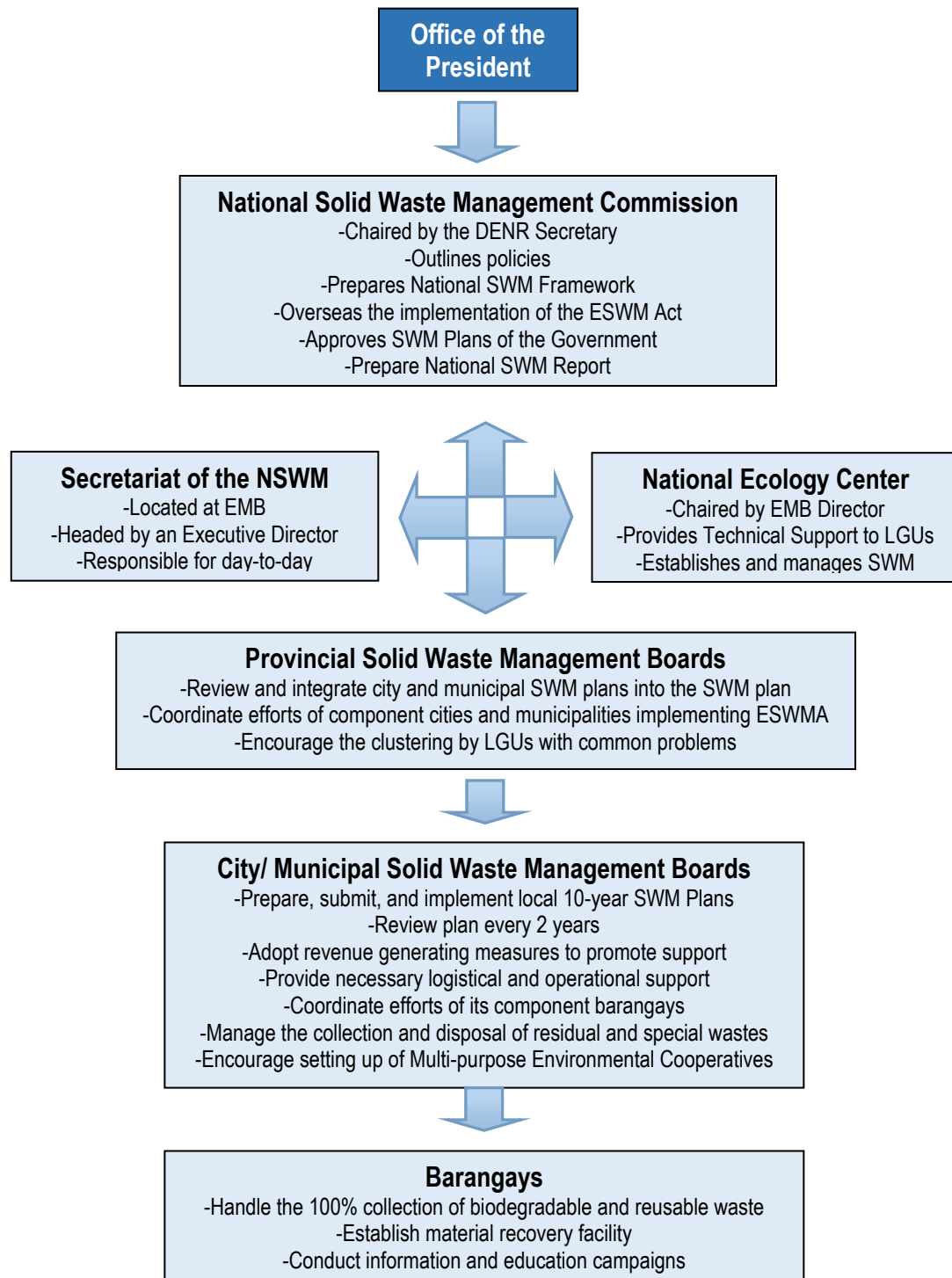


Figure 4. Agencies and key officials involved in the implementation and their salient tasks (Source: World Bank 2001: *Philippine Environment Monitor 2001*)

To strengthen the implementation of this Act in the local level, the Provincial Solid Waste Management Board (PSWMB), headed by the Governor, was also established in each province. PSWMB is responsible in developing a provincial solid waste management plan which is based on the solid waste management plans of their respective City and Municipal Solid Waste Management Boards (CMSWMB). After reviewing and integrating the plans of the CMSWMB, the Provincial Solid Waste Management Plan (PSWMP) is then submitted to the National Solid Waste Management Commission (NSWMC) for approval.

The organizational structure of solid waste management is headed by the National Solid Waste Management Commission (NSWMC), formed under the office of the president to supervise the overall implementation of the programs (Figure 4). With the Secretary of DENR as the chair, the members come from 14 government agencies and three from the private group, including representatives from NGOs, the recycling industry and from the manufacturing and packaging companies.

To further strengthen RA 9003, incentives and penalties are provided for persons, private organizations, NGOs, and LGUS that contribute or violate the provision. More importantly, administrative sanctions are imposed on LGUs and GOs who have failed in enforcing the implementing rules and regulations.

Provincial Level

Provincial Ordinance No. 2008-01 (The Cavite Environment Code)

The passage of Provincial Ordinance No. 2008-01 (The Cavite Environment Code) seeks to attain the sustainable development of the province without sacrificing the quality of the environment. The Code aims to ensure the protection, preservation, restoration, and enhancement of the province's forest, mineral, water, marine, and coastal resources.

To effectively implement the provisions in this Code, the Provincial Government – Environmental and Natural Resources Office (PG-ENRO) was created with four functional divisions, namely Waste Management Division, Land Management Division, Integrated Coastal Management Division, and Operations Division.

Provincial Ordinance Number 007-2012 (Regulating the Use of Plastic in the Province of Cavite)

This ordinance known as “The selective plastic ban and the use of eco bag ordinance of the Province of Cavite” was unanimously approved by the Sangguniang

Panlalawigan of Cavite in 2012. It aims to minimize, if not eliminate activities, products and services that generate residual waste and to promote practices that will prevent or reduce residual waste generation in the province. Section 5 of this ordinance lists the types of plastics which are prohibited while Section 6 stipulates how to regulate use of plastics for goods and commodities.

To strongly push for compliance, fines and penalties for those who violate the provisions of this ordinance are stated in Section 8. Seventy-five percent (75%) of the amount collected goes to the LGU and twenty-five (25%) are incentives to the person/s who reported the violation. The LGUs collect the fines and penalties from the violators.

In an interview with Anabelle Cayabyab, the Provincial Government Environment and Natural Resources Officer (PG-ENRO) of Cavite, the use of plastic bags, particularly the “sando bag”, for carrying goods increased exponentially owing to the upsurge in delivery services from 2020 due to social distancing protocols. Also, amendments to the penalties incurred by commercial and non-commercial establishments are in the pipeline because currently, the penalties (Table 7) imposed are surmised as ineffective.

Table 7. Fines and penalties

Level of Offense	Individual	Business Establishment
1st Offense	PHP 100	PHP 2,000
2nd Offense	PHP 300	PHP 3,000 and suspension of business permit/operation at the discretion of LGU
3rd Offense	PHP 500 and/or imprisonment of one month at the discretion of a competent court	PHP 5,000 and cancellation of business permit (mayor's permit) by the concerned LGU

Prior to the passage of this provincial ordinance, some cities and municipalities have promulgated their own ordinances to reduce the use of plastic in their respective area while others opted to adopt this ordinance through council resolutions.

Such penalties are quite stiff, especially in the business sector. There is, however, a difficulty in the monitoring and implementation of these penalties: violators must be caught red-handed using these plastic materials.

The Dasmariñas City Environmental Sanitation Unit (ESU) head explained that it is also not possible to apprehend the actual source of residual waste because

businesses often hire disposal companies to dump their garbage and thus, tracing ownership is tricky. Likewise, individuals are very discreet in disposing their plastic wastes and usually, garbage materials are thrown during the night in the cover of darkness.

Provincial Government of Cavite
Provincial Government – Environment and Natural Resources Office

**MONITORING OF COMPLIANCE TO PROVINCIAL ORDINANCE 007-2012
(Plastic Regulation Ordinance)**

Name of establishment/office: _____
 Name of owner (if applicable): _____
 Name of Pollution Control Officer (PCO) (if applicable): _____
 Date of inspection: _____
 Time of inspection: _____

OBSERVATIONS/FINDINGS

PROHIBITED

- ☐ 1 Use of plastic bags for dry goods
- ☐ 2 Use of plastic bags for wet goods
- ☐ 3 Use of Styrofoam products
- ☐ 4 Use of plastic utensils
- ☐ 5 Use of plastic pouch for beverages
- ☐ 6 Use of plastic drinking straws
- ☐ 7 Use of plastic cups
- ☐ 8 Use of plastic bag as garbage bag
- ☐ 9 Use of secondary packaging for wet goods (*pagdodoble ng plastik labo*)
- ☐ Others: _____

BEST PRACTICES

- ☐ 10 Use of ecobags/reusable bags
- ☐ 11 Use of paper bags
- ☐ 12 Use of paper cups
- ☐ 13 Use of Tupperware/ recyclable plastic container
- ☐ 14 Use of reusable utensils
- ☐ 15 Use of reusable plates, bowls, etc.
- ☐ 16 Use of reusable cups, glass, mugs, etc.
- ☐ Others: _____

Inspected by: _____ Noted by: _____
 Signature over printed name Signature over printed name

Figure 5. Monitoring compliance of provincial ordinance

A monitoring checklist (Figure 5) is used to ensure that different business establishments and offices in different cities/municipalities in the province comply with ordinance number 007-2012. PG-ENRO, in coordination with different LGUs, conduct surprise inspections to check the presence and use of prohibited items listed in the provincial law. Likewise, best practices of the establishment/office visited are noted for future engagements and recognition.

The coordination with LGUs is crucial for PG-ENRO’s monitoring task because checking the compliance of a total of 829 barangays in the Province of Cavite needs to be done periodically.

City and Municipality levels

Localized policies have also been promulgated by cities and municipalities in Cavite (Table 8).

Table 8. Local government units with plastic ordinance

City/ Municipality	Ordinance No. / Title	Date Approved
Carmona	Municipal Ordinance No. 004-09 Selective Plastic Ban and Eco-Bag Ordinance	August 12, 2013
City of Bacoor	Municipal Ordinance No. 14-s-2002 Regulating the Distribution of Plastic Bags and Polystyrene Providing Penalties Thereof Executive Order No. 12-s-2011	January 12, 2012
Trece Martires City	City Ordinance No. 2011-194	August 23, 2011
City of Dasmariñas	City Ordinance No. 03-s-2012 Ordinance Regulating the Use of Plastic Bags and Styrofoam in the City of Dasmariñas	April 10, 2013
Tanza	Municipal Ordinance No. 23-s-2011 Regulasyon at Pagbabawal sa Paggamit ng Bagay na Gawa sa Plastic	June 01, 2011
Magallanes	Municipal Ordinance No. 2011-004	July 04, 2011
Tagaytay City	City Ordinance No. 2011-025 An Ordinance Prohibiting the Use of Plastic Bags on Dry Goods, Regulating the Utilization of Plastic on Wet Goods, Prohibiting the use of Styrofoam/styrophor in the city and prescribing penalties thereof	January 24, 2012
Maragondon	Municipal Ordinance No. 097-s-2012 An Ordinance Adopting the Gen. Trias Solid Waste Management Code and providing penalty for violation thereof, subject to all laws and existing legal rules and regulation	February 17, 2012
Gen. Trias	Municipal Ordinance No. 12-03	February 20, 2012
City of Imus	Ordinance No. 2012-134 An Ordinance Prohibiting the use of Plastic Bags on Dry Goods, Regulating its Utilization on Wet Goods and Prohibiting the Use of Styrofoam/Styrophor in the City of Imus and Prescribing the Penalties thereof	June 15, 2012

Source: Cavite Socio-Economic and Physical Profile 2013

The ordinances promulgated at the city or municipal level strengthen the provisions of RA 9003. In particular, the ordinances attempt to regulate the distribution and use of plastic and its products, such as the ubiquitous “sando” bag extensively used in

wet markets. Most of the provisions are almost 10 years old, and hence, their implementation may be expected to be established at this point.

The City of Imus has been at the forefront in the fight against the proliferation of plastic wastes specifically those which find their way into the murky waters of the Imus River. In this regard, it has implemented preventive measures such as the legislative passage of Ordinances on plastic usage to regulate their utilization in wet goods. Other measures similar in nature had also been embedded in the Code of Imus City. Likewise, constant solid waste management seminars to its designated environmental employees have been conducted to make them competent officials in the struggle to rid the city of unwanted wastes e.g., plastic.

As actual guardians of the Imus River, the Imus Environmental Police has been patrolling its slopes and slippery sides with the intention to catch off-guard potential violators and impose on them the payment of fees as sanctions. These enforcers (around 10 in the field at the same time) are given salaries to monitor garbage violators. They have also inter-linked with the Provincial guardians under the program “Bantay Linis Ilog” Rangers.

Problems have hounded Imus’s programs to hasten the city’s clean-up efforts to get rid of plastic wastes. One is the lack of environmental awareness among its local constituents and thus, plastic materials are not properly disposed. Another problem is the perception of lack of alternatives in the proper disposal of garbage as collection of waste has been irregular and disorganized.

To further supplement its efforts, the city has also partnered with private industries such as Yazaki, which tasked itself in the conversion of foil packs to bags. Local junkshops had also been tapped to receive local plastic wastes and, likewise, supplement the meager income of households living below the poverty line. Another company, CEMEX, was also engaged to collect plastic and transform them into usable products. A supporter of such initiatives was also found via Annie’s Candy Manufacturing, which has chipped in the battle against plastic wastes.

In 2019, the city also launched the highly touted Eco-caravan which was mainly addressed to collect recyclable plastics. An off shoot of such program is the “Tindahan ni Aling Puring” which provides goods to be bought by recyclable wastes such as plastics at the rate provided by junkshops e.g., one kg of rice in exchange for one kg of plastic. Their program Barangay Basura Raffle (to be further discussed) was also conceptualized to encourage constituents to collect their own plastic wastes. Segregation of wastes had also been observed in the barangays and the DENR had also helped by putting up a large net across the river as a trash trap (Figure 6).



Figure 6. Trash trap kept at the bank of the river

In the Municipality of Kawit (Pulvorista), the barangay spearheads the education of the people living along the riverbanks and mobilizes volunteers to clean-up every week. In the house of one of its local leaders, various plastics are segregated and ready for disposal to local junkshops and other interested parties.

In the City of Bacoor (Salinas), the barangay distributes carts to barangay volunteers, and these carts enter the subdivisions to collect wastes such as plastics. These carts are also sources of livelihood for some of the volunteers who usually belong to the poverty class. The barangay also has a storage facility for recyclable materials such as a Recyclables Materials Facility.

The cities of Imus and Dasmariñas and the Municipality of Silang are also at the forefront in the fight against plastic pollution. Imus is the primary mover in the BasuRaffle (discussed later) and the Basura Caravan. Dasmariñas engages river watchers and provides information materials e.g., pamphlets for proper garbage disposal. Silang likewise engages barangay rangers, engages in weekly clean-ups, and has an information drive.

Tracing the Trails of Plastic Disposal

Tracing the trail of plastic waste from the household and or/establishment (Figure 7) is important to identify at which stage/s initiatives could be done to manage its disposal through various means.

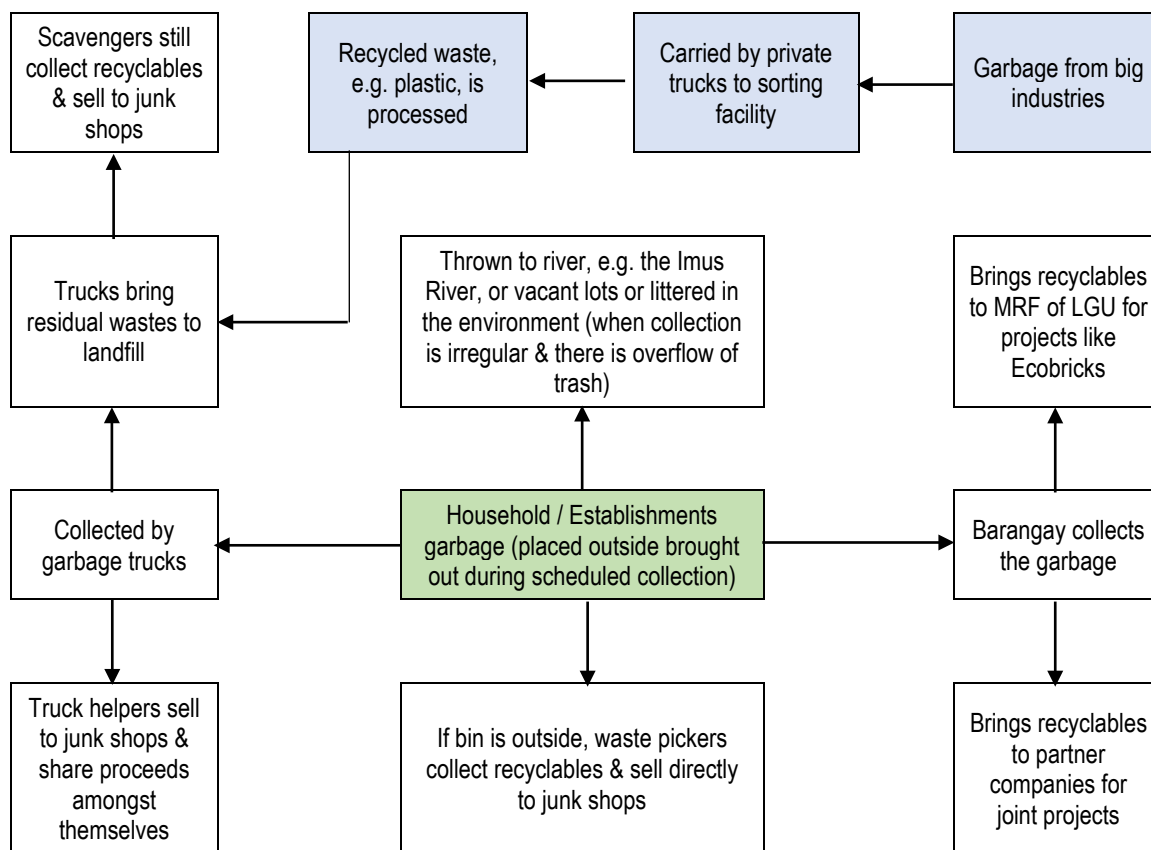


Figure 7. Tracking plastic waste

Results from the survey and KIIs indicate that:

1. High-value recyclable packaging is already separated from household waste to a limited extent and transferred to recycling systems. This applies especially to rigid HDPE, PP and PET. Extraction is largely informal and the subsequent value chain is based on a functioning market. A sizeable volume of these high-value recyclable packaging still ends up in disposal sites or leaked to the environment.
2. Plastics that are recyclable, especially those considered *sibak* (HDPE, PP and PET) are already removed by waste pickers from household garbage bins found outside houses even before collection is done by the city/municipal waste management system. However, for households or business enterprises which do not place their bins outside and wait for the garbage truck, garbage helpers, who are not officially employed by the local government sort during collection. They carry such recyclables to the junkshops where they are paid per piece or per kg. Junkshops in turn, sell the recyclable materials to company collectors for recycling.

3. Materials of little to no-value and non-recyclables (e.g., sachets, and composites) are disposed of and collected along with other residual wastes because sorting and segregation are not practiced at the source, i.e., the household or establishment. All of these ends up in sanitary landfills, dumpsites, or are littered in the environment, including the waterways.

In some areas, the country's smallest unit, the barangay, initiates collection of the recyclable wastes via garbage carts or citizen volunteers. The Barangay stores these plastics at their Recyclable Materials Facility (RMF). Such plastics are either processed by local government units or private companies.

Waste from big establishments and industries, e.g. supermarkets, have their own private concessionaire trucks that collect and bring their garbage to sorting facilities where recyclables are segregated from disposable waste, and the latter is brought to the landfill.

Perceived Best Initiatives

Part of the survey conducted in this study is identifying the best initiatives the respondents are aware of. Of the 300 respondents, 114 (38%) gave a response while the rest could not remember an initiative to curb plastic waste (Table 9).

Table 9. Perceived best initiatives on plastic waste

Initiatives	Frequency	Percentage
Clean up drive /River clean up	105	35.0
Waste Segregation/management	5	1.7
BasuRaffle	2	0.7
Eco brick making	1	0.3
Oplan Iwas Plastic	1	0.3
Does not know	186	62.0
Total	300	100

For the 38% who named a best practice, follow up questions were asked on how these initiatives are managed. It seems most are only aware of one practice, the River Clean-up/Clean up drive. This is understandable due to its regular visibility.

Other practices, which may be more efficient and effective, are not as visible, and apparently not promulgated to the communities.

Thus, there is a need an information campaign on other practices that the government is undertaking. This will allow local communities to better contribute to the success of such practices.

Local leaders like the barangay captains and Sangguniang Kabataan (SK) officers actively participate in the river clean-up. Since most of the participants in clean-up drives are volunteers, the barangay captains usually provide “merienda” (snacks) after the activity. The money used to buy the snacks usually comes out of the personal pockets of the barangay officials.

There is coordination between the City Environment and Natural Resources Office (CENRO)/Municipal Environment and Natural Resources Office (MENRO) and the different barangays during river clean-up activities. In CENRO Imus for example, the CENRO Imus River Rangers (Figure 8) also participate in the river clean-ups of the different barangays in Imus.



Figure 8. River rangers cleaning trash trap in the river

Some SK officers also narrated that clean-up drive volunteers attend an orientation tackling the importance of the river and of the initiative. The volunteers can be easily contacted every time there is a clean-up, as most of them reside near the Imus River.

There is also a high degree of agreement among the respondents on the adequacy of personnel that supervise and monitor the clean-up activity. Moreover, the same rating was given to the effectiveness of communication between and among the different stakeholders of this activity, and their barangay captains. SK Officers are construed to influence, inspire, and drive the residents to become committed to the activity. Overall, the respondents are satisfied with the way plastic waste is handled in their respective barangays.

Alternative Actions

Table 10. Actions that local authorities need to do

Actions	Mean	Interpretation
1. Create a training program on sorting and storing of plastic waste.	4.13	High
2. Implement the sorting and storing of plastic waste.	4.22	Very High
3. Improve the plastic waste collection system.	4.28	Very High
4. Provide incentives for waste sorting.	4.14	High
5. Launch a campaign program on plastic waste.	4.27	Very High
6. Feature best practices in plastic waste management	4.41	Very High
7. Initiate periodic cleanup drives to address plastic waste	4.26	Very High
8. Disseminate information on the danger and hazards of plastic waste	4.28	Very High
9. Monitor and penalize improper plastic waste disposal	4.32	Very High
10. Implement existing policies on waste management consistently	4.30	Very High
11. Provide source of income through plastic waste management	4.19	High
12. Mandate schools/establishments to strongly implement plastic waste management	4.19	High
Mean	4.25	Very High

The survey also provided for the perception of the respondents relative to general waste management in the province. When asked what local authorities should do (Table 10), residents desire to find a model of what best practice is, followed closely by serious implementation of laws including the meting out of penalties. The barangay leaders of Tubuan 1, Silang, support the imposition of fines to repeat offenders because the community has responded well to the threat of punitive actions via fines in other initiatives. In Tanzang Luma 6, Imus, however, the prevailing

practice is on the use of rewards to motivate compliance. The local government's widespread use of bestowing awards and giving incentives to barangays showing exemplary efforts supporting the city's projects have worked, and hence, in terms of plastic waste management, giving groceries in exchange for plastic has been a long-standing program.

The top 2 and 3 perceptions show that the people in Cavite are aware of the shortcomings of the Philippine government when it comes to addressing the plastic waste problem, specifically the lack of teeth in the implementation of policies at the management level. In this regard, local governments need to improve their policy implementation and practices.

In the management and implementation of government initiatives to solve the plastic waste problem, it is essential that people in the community participate in such initiatives to achieve a high degree of success. The government cannot function without active participation by at least some of its citizens (UCF pressbooks online, 2016).

Local Best Initiatives

Of the 114 respondents who responded to the item on best initiatives addressing plastic waste pollution in the province (Table 11), 92.11% pointed out *clean up drive* to be the only initiative that they knew. This suggests that most residents in the communities are not aware of the other programs, projects, or policies initiated by the local government units.

This led the researchers to find alternative ways to identify outstanding practices on plastic waste management, apart from what the respondents generally knew. Hence, key informant interviews of government officials (from different levels) included this question. Several initiatives deemed “magaling, nakakatulong, nakabawas sa problema ng basura, maraming nagawang kabutihan” (great, helpful, reduced garbage problem, beneficial) came out during the interviews. This was extremely valuable, but the question remains: how is “best practice” operationalized? This prompted desk study on exemplary waste management initiatives to identify the parameters that can best determine what is best practice (Table 13).

At the outset, the consensus was that the single most important initiative should be directed at controlling and limiting the manufacturing, sale and use of plastic and its products. However, initiatives on these have not come out from interviews. What was common from the interviews is the theme “recycling is best practice, especially

when it involves large volumes of plastic, which are otherwise just thrown in the river, or littered on the streets and vacant lots.” A cursory observation of the thoroughfares of Cavite and the Imus River tributaries are indicative of the magnitude of the wanton use and disposal of single use plastic: the KIIs might be on point that the best initiative is more on giving plastic a second life rather than halting its manufacture and/or utilization, which seems unattainable.

As evidenced by the 2020 WWF study of the Philippines’s usage of plastic, out of the 2,150k tons of plastic that are available for local consumption, 760k tons or 35% are leaked to the open environment while 706k tons or 33% are disposed to landfills and dumpsites. Approximately 345k tons or 16% are stored and in-use. Hence, halting the manufacture of plastic or limiting its use seem a Herculean task, not a feasible action.

The present study considered the question on how plastic is collected and recycled in the choice of a model for exemplary plastic waste management. The pivotal element weighed was on which models adopted recycling strategies, directly or indirectly (passed on to specific group that recycle) implemented by any individual or group.

The Wangwa Waste Management Model

From among several models, the parameters used in the Wangwa Waste Management Model was adopted as it presents a viable strategy to manage the unrestrained disposal of single plastic in the province of Cavite through different recycling strategies.

The Wangwa Waste Management Model was established in 2013 by Mr. Sayan Rungreaung, a local environmental advocate in Thailand (<https://www.sea-circular.org>. 2020). The model used six indicators (Table 11) on the assessment of waste management in the Wangwa community, which is in the Kleang District of Rayong on the eastern Gulf coast of Thailand.

Table 11. Wangwa waste management model indicators

Indicators	Descriptions
Self-sustaining circular system	<ul style="list-style-type: none"> Initiative promotes material reuse, recycling, and transformation into new products, creating a circular economy that curbs waste entering the environment. This is driven by a community that is involved, understands the need to sort waste at source, and possesses the right knowledge.
Appropriate technology and local capacity	<ul style="list-style-type: none"> The waste management system should be affordable and simple, and something a community can handle.

	<ul style="list-style-type: none"> • Easy, accessible innovation and technology can be sustained over longer periods of time.
Community commitment and partnerships	<ul style="list-style-type: none"> • A committed community leadership supported by its members, with a successful network of local authorities and related businesses are united to collaborate on improving waste management and reducing plastic waste.
Enhanced community knowledge	<ul style="list-style-type: none"> • Continuous efforts to educate and raise awareness among the constituents, especially the younger generation, on the management and sorting of waste including plastics are entrenched in the community of practice. • Responsible consumption patterns are promoted among community members, encouraging them to segregate waste at home.
Income for the community	<ul style="list-style-type: none"> • Recycling plastics and processing organic waste have brought economic benefits to the community.
Measurable impacts	<ul style="list-style-type: none"> • Higher quality recyclables: Segregating organic waste from the other waste streams minimizes contamination and improves the quality of recyclable items such as plastic bottles, aluminum cans, etc.

Source: *The Wangwa community model (2013)*

Using the Wangwa Waste Management Model (2013), the initiatives deemed effective in addressing the plastic waste issue in their community by LGU informants were collated (Table 12). A matrix was created to indicate the score of the initiatives using the Wangwa Model, and discuss the merit of each based on the information provided by the informants, as well as a review of published reports on them. Each of the initiatives was then scored from 1 to 3 in each criteria.

Table 12. Scoring the best initiatives from key informant interviews

Best Initiative	Criterion 1	Criterion 2	Criterion 3	Criterion 4	Criterion 5	Criterion 6	Total score
Name	Self-sustaining circular system	Appropriate technology and local capacity	Community commitment and partnerships	Enhanced community knowledge	Income for the Community	Measurable Impacts	
Kawit							
1. Information Campaign	1	1	2	2	1	1	8
2. Individual Sorting	1	1	1	1	1	1	6
3. Dredging	1	1	1	2	1	1	6
Bacoor							
1. War on Waste	3	3	3	3	3	2	17
2. Salinas initiative (trap, basura cart, junkshop)	3	3	3	2	3	1	15
Imus							

1. Basura Raffle	3	3	3	3	3	3	18
Dasmariñas							
1. Tumbler Challenge	1	1	1	2	1	1	7
2. DLSU-D Solid Waste Management Program	3	3	3	2	3	3	17
3. Brgy. Salitran II, Plastic Mo, Bigas Ko	1	1	2	3	3	3	13
Silang							
1. Waste to Ecobricks	3	3	3	3	1	3	16
2. Palit Bigas Program	1	1	2	3	3	3	13
3. Ordinance PB-017, "organiks" composting	1	1	3	3	1	1	10

Scoring: 1 (criterion not fulfilled), 2 (criterion partially fulfilled), 3 (criterion fulfilled)

The top three initiatives based on scoring are as follows: first, with 18 points, is the BasuRaffle (Imus); in second place are two initiatives tied at 17 points, the War on Waste (Bacoar) and DLSU-D Solid Waste Management of DLSU-D (Dasmariñas). The team agreed to drop the DLSU-D initiative due to conflicts of interest. The replacement is Waste to Ecobricks (Silang), which scored 16.

Waste to Ecobricks Technology

This is a Local Government Initiative of the Municipal Environment and Natural Resources Office of Silang. Plastic, foil, and other residual wastes are collected, shredded, and mixed with cement to create eco-friendly construction hollow blocks called “ecobricks”. The finished product can be used to build various infrastructures such as houses, schools, and buildings (Figure 9).

According to Merlina Cabrera, head of the MENRO of Silang, the municipality were given a PHP 9.5 million grant in 2017 by DENR Environmental Management Bureau (EMD) Region 4-A to have technologies to address residual plastic waste. One of the technologies that MENRO Silang implemented from this grant is the waste to ecobricks technology wherein laminated plastics are collected from different barangays and processed to produce ecobricks.



Figure 9. The operations manager's office in MRF Silang is made of ecobricks

Self-sustaining circular system

The residents of Silang are the beneficiaries of the ecobricks from the materials recovery facility (MRF). According to Ms. Cabrera, the health clinic of Barangay Tartaria in Silang used these ecobricks. Moreover, the ecobricks were also utilized in creating landscapes of ecogardens in different barangays and in the construction of some barangay halls in Silang. Ecobricks were also offered to different barangays and schools as a reward for their strict compliance to environmental policies and ordinances. Other local offices which incorporated ecobricks are the following: MRF office, Barangay Iba Day Care Center and West Central Elementary School.

Appropriate technology and local capacity

The MRF of Silang produces two types of ecobricks. The first type (ecobricks) uses sand, cement, small gravel rocks, water and shredded plastic foil. The second type (plastic ecobricks) is made using used cooking oil, shredded single use plastics, and small gravel rocks. The ecobricks use shredded plastic with foil minimally while the plastic ecobricks use it extensively.

A brief overview of the technological process for the ecobricks is as follows:

1. Put four box of sand, two to five kg of shredded plastic foil, one sack of cement, two shovels of small gravel rocks and ten liters of water to the mixer and mix it for 15 min.



2. After mixing for 15 min, put the mixed materials into the molding machine and apply some pressure to mold the bricks.



3. Put the molded ecobricks in a rack to dry for one day. After one day, soak the ecobricks in water for 15 sec to release the bubbles. When bubbles are no longer present in the water, remove the ecobricks out from water and arrange them in a shelf placed in an open area for drying.

4. The ecobricks are ready for disposal after a day of drying. The procedure they use can produce 44 pieces of ecobricks. According to Herry Caballero, the Operations Manager of MRF Silang, one ecobrick can withstand a pressure of 475 pounds per square inch (PSI).



As regards the technological process for the plastic eco-bricks it consists of the following steps:

1. Filter 25 L of used cooking oil. After filtering, put the filtered cooking oil into the plastic densifier. Boil the cooking oil until it reaches 165°F



Plastic densifier machine

2. Add 25 kg of shredded single use plastics into the plastic densifier. Wait until the temperature reaches 210°F.



Shredded single-use plastics

3. When the temperature reached 210°F, scatter a few small gravel rocks into the molding plates and pour the boiled used cooking oil from the plastic densifier. In a few seconds, the plastic ecobrick will solidify. The plastic ecobricks will go through the cleansing process.



4. The finished product is called plastic ecobricks. This procedure can produce fifty-six pieces of plastic ecobricks in one cycle. According to Herry Caballero,

the operations manager of MRF Silang, one plastic ecobrick can withstand a pressure of 325 pounds per square inch (PSI).



Herry Caballero, the OIC of MRF Silang, showing the finished plastic ecobrick

There are four employees involved in the production of bricks: one operations manager, one assistant operations manager, and two laborers. All employees undergo training in ecobrick manufacturing from PG-ENRO. All manufactured eco-bricks are stored in the MRF of Silang (Figure 10).



Figure 10. Silang Central MRF

Community commitment and partnerships

According to Ms. Cabrera, the municipal government of Silang, in cooperation with Aksyon Kalikasan (Eco Actions Ph), Inc., a membership-based socio-civic organization for environmental concerns, check the proper implementation of the Kautusan Bilang PB-014 Serye 2020 (Order Number PB-014 Series of 2020) municipal ordinance.

Section 3 of this ordinance states that no business establishment or individual will be permitted to use single-use plastic bags as containers for dry and wet goods, either in primary or secondary packaging, and Section 4 states that no business establishment or individual will be allowed to use plastic bags as containers and/or pouches for food and other products. The use of disposable styrofoam eating utensils such as plates, spoons, glasses, and other containers for commercial or personal use is also prohibited in the Municipality of Silang.

Section 7 of this ordinance also states that there will be a Technical Working Group for the proper and effective implementation of this order. This includes MENRO Silang, the Municipal Economic and Investment Promotions Office (MEIPO), markets, a representative of the Silang Business Association, NGOs, Chairman of the Association of Barangay Captains, Chairman of the Federation of the Sangguniang Kabataan, and the Municipal Engineer.

In addition, the LGU also organized a Municipal Environmental Monitoring Team to check the environmental compliance of all industries within Silang.

To produce ecobricks, plastic wastes collected from the different barangays are brought to the MRF while several restaurants in Silang like Balinsasayaw, Salakot Al Fresco Dining & Café and Jollibee Corporation voluntarily bring their used cooking oil to the MRF which can be used as a material in producing the plastic ecobricks. Even the small ambulant vendor in Silang contribute by bringing their used cooking to MENRO Silang Office.

Enhanced community knowledge

Ms. Cabrera explained that in order to curb the problem of plastic wastes in Silang, the municipality passed the *Kautusan Bilang PB-014 Serye 2020* (Order Number PB-014 Series of 2020) authored by Municipal Councilor Luciano De Jesus Jr, who is also the Committee Chair on Environment and Natural Resources This ordinance titled “*Ordinansa sa Pagbabawal ng Paggamit ng Single-Use Plastic* (Single-Use Plastic Prohibition Ordinance)” was approved on July 6, 2020 and prohibits the use of single use plastic, promotes the use of alternative materials and imposes penalties on

violators. The penalties for violating in this ordinance are as follows: 1st offense - PHP 1,000.00, 2nd offense - PHP 1,500.00 and for the 3rd offense – PHP 2,500.00 and suspension of business permit license for at least a year.

MENRO Silang also have its official Facebook page where all information of on-going and incoming activities/programs and projects are posted. In addition, the office also conducts Information Education Campaign (IEC) to the residents of the different barangays in the municipality to inform and teach them on the proper way of waste segregation.

Income for the community

According to Ms. Cabrera there is no income generated from the ecobricks program since the ecobricks are not for sale. However, in Barangays Tartaria and Pulong Saging, these two barangays have a “Plastic Mo Palit Bigas Program”. The project gives the residents of the barangay one kilogram of rice in exchange for a kilogram of plastic. Barangays and schools who benefited from the ecobricks program were able to save money in terms of construction materials cost in building of facilities in their barangay.

Measurable impacts

The MRF head, Mr. Caballero revealed that before the ecobricks program, the volume of waste they collect per day is twelve trucks. After the implementation of this program, the volume of waste collected per day were reduced to eight trucks. He also mentioned that the cost of renting a truck to collect the municipality’s garbage is PHP24,000.00 per trip of the truck. This means that the municipality were able to save PHP96,000.00 per day because of the program.

BasuRaffle

Basuraffle is a Local Government Initiative of the City Environment and Natural Resources Office of Imus, its name a wordplay on *basura* (Filipino term that means trash) and raffle. Under the project initiated in February 2017, the residents collect and turn over to the city’s waste disposal facility a kilogram of plastic (made up of plastic sando bags and wrappers) in return for a ticket to win prizes raffled by the city government.

Self-sustaining circular system

The collected plastic residuals are turned over to the Villar Foundation's recycling facility in Las Piñas to convert the plastic residuals into armchairs. The armchairs are distributed to different public schools in Metro Manila and nearby provinces like Cavite. Cities and municipalities who turned over their plastic residuals to the foundation are usually the primary beneficiaries of the armchairs. According to Ms. Doris Sagenes from the Imus city environment office, "Between February and September of 2017, we [in Imus City] have collected 10 tons of plastic residuals and the Villar Foundation gave us 100 pieces of school armchairs in exchange of the solid waste collected".

According to the official website of the City of Imus, in April 2020, this initiative generated 22,637 kg of plastic residual waste of which a part was brought to Cemex. Cemex is a cement factory accredited by the Department of Environment and Natural Resources (DENR) to recycle plastic residuals to produce eco-bricks. The eco-bricks are then used in the different facilities of the city (Figure 11).



Figure 11. Imus City Website showing the technology for plastic residuals

Appropriate technology and local capacity

The mechanics of the initiative is very simple: residents from different barangays in Imus collect plastic “labo” (single use plastics), plastic wrappers, candy and biscuit wrappers, sachets (e.g., coffee, shampoo, laundry, etc.), tetra packs, medicine blisters, metallic foils, cigarette foils, and delivery packaging from different online sellers. The residents will bring to the barangay hall the plastic residuals they have collected. One kilogram of plastic residuals is equivalent to one raffle ticket. Different prizes are at stake during the monthly draw. Raffle entries that were not drawn during the monthly draw are still included in the grand raffle draw every December, where bigger prizes are at stake. The Office of CENRO is the venue where the raffle draw is being held.

Community commitment and partnerships

CENRO Imus, being the main implementor of this initiative, coordinates with the different barangay captains to promote the initiative in their respective barangays. This includes dissemination (Figure 12) of all information and mechanics about the initiative and the collection of the different kinds of plastic residuals from the residents of their barangay. All plastics collected at the barangay level were picked-up by CENRO from the barangay’s material recovery storage. According to CENRO Imus, 75% of the barangays are consistently joining BasuRaffle for the past five years of its implementation.



Figure 12. Sample posters of BasuRaffle

According to CENRO Imus, in addition to the participation of the different barangays in Imus City, Annie's Sweets Manufacturing & Packaging Corporation (ASMPC), a candy manufacturer located in JICA Road Barangay Buhay na Tubig in Imus City, also participates in the BasuRaffle. They deliver shredded plastics to CENRO but do not collect the tickets for the raffle. ASMPC is the manufacturer of Annie's Hany Milk Chocolate a well-known brand of peanut bars in the Philippines.

Enhanced community knowledge

CENRO Imus is the lead office in the execution of environment policies, programs, projects and activities headed by the City. Using their official Facebook Page (<https://www.facebook.com/cenro.imus>), constituents of Imus are informed of the different projects and activities being implemented by the office (Figures 13-16). This includes river clean-up activities, garbage collection advisories, BasuRaffle live draw, waste management of facemasks and face shields, segregation of plastic waste for the BasuRaffle, and even commending barangays with best practices in waste management, among others.

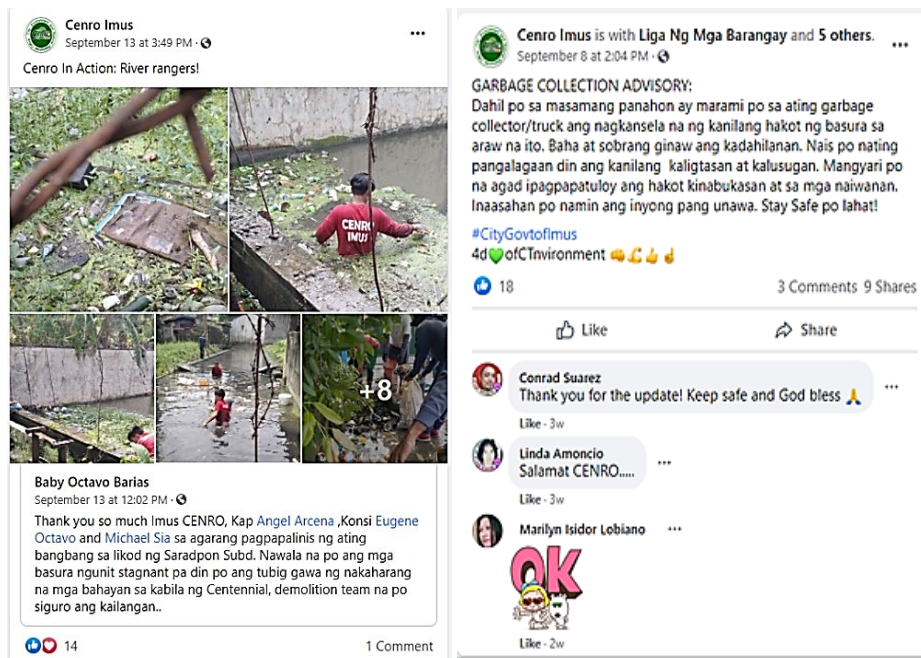


Figure 13. River cleanup activity (L) and garbage collection advisories (R)

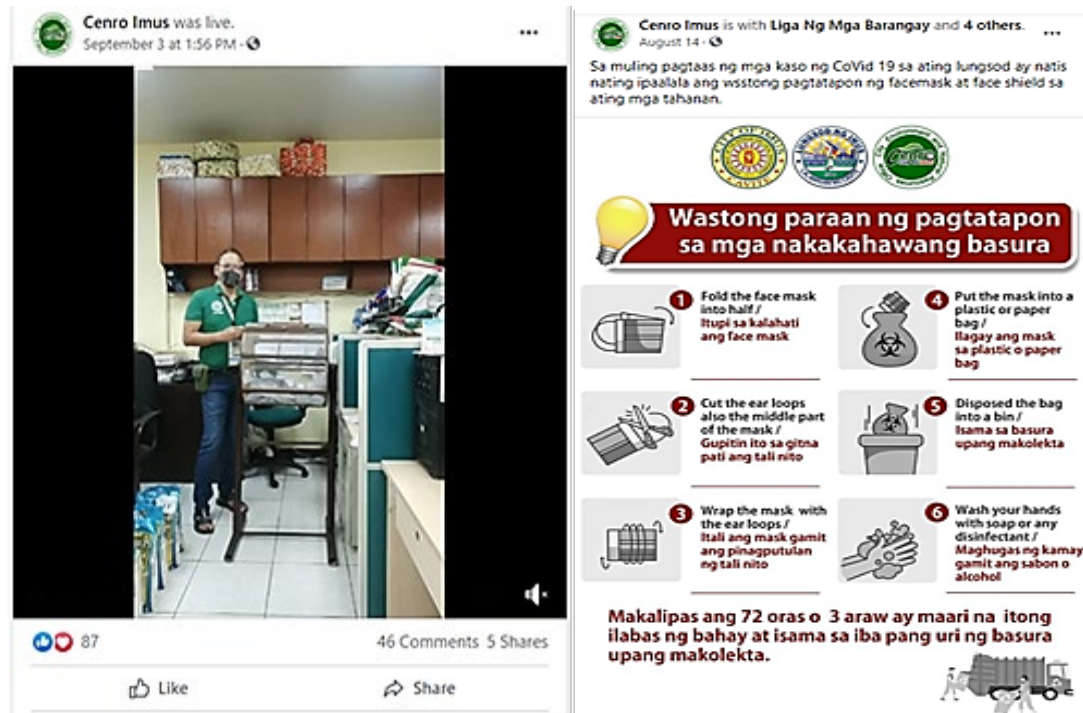


Figure 14. BasuRaffle live draw (L) and waste management of PPE (R)

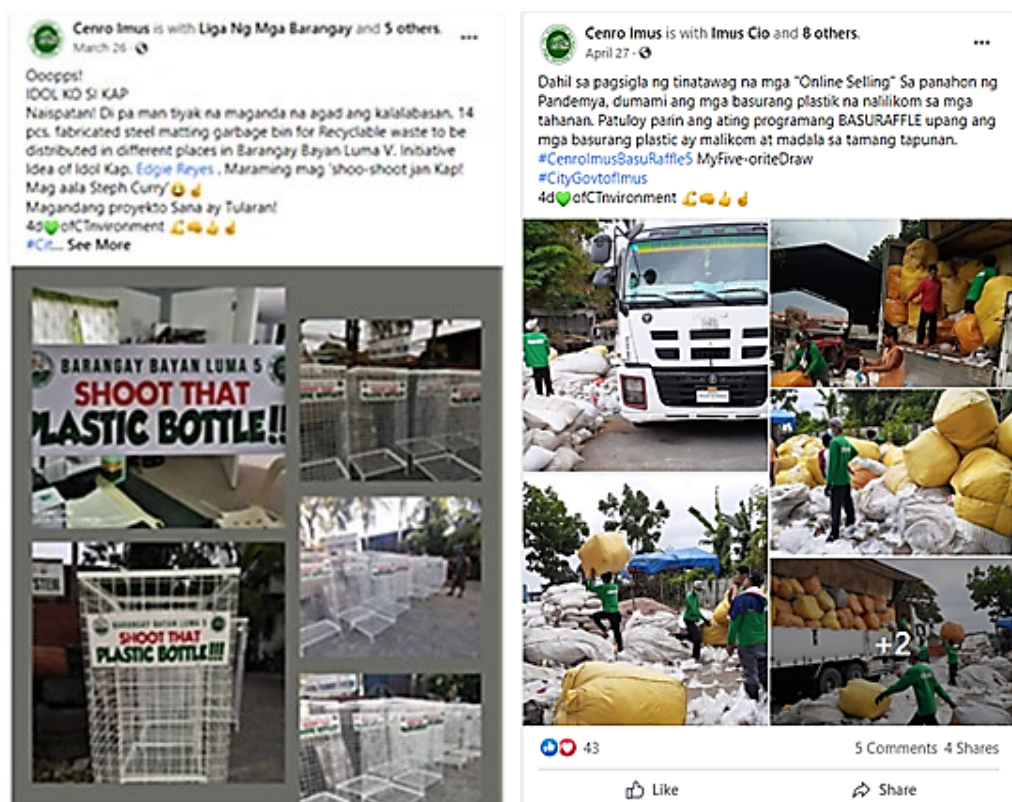


Figure 15. Commending barangays with best practices (L); segregation of plastic waste (R).



held 09/03/2021 @ 5/F CENRO, IMUS CITY HALL BUILDING

TICKET No.	PRIZE	BARANGAY	NAME
23042	STAND FAN	BUCANDALA 4	JIMMY ACUÑA
07498	DESK FAN	POBLACION 4	PABLO LIBUNAO
20978	DOUBLE BURNER	BAYAN LUMA 1	EDUARD FAJARDO
33021	RICE COOKER	ALAPAN 1-C	ROSIE
26676	OVEN TOASTER	BAYAN LUMA 1	REA CALIVA
26675	FLAT IRON	BAYAN LUMA 1	REA CALIVA
20559	ELECTRIC KETTLE	ANABU 1-A	CARMELA PAYOS
13483	SINGLE BURNER	POBLACION 1-A	LIZA MENGUITO
23177	5 KG. RICE	POBLACION 4-A	JAQUELINE ROQUE
26170	5 KG. RICE	ALAPAN 1-C	VIRGILIO LARANGAN
26668	5 KG. RICE	BAYAN LUMA	JANE BALMACEDA
22389	5 KG. RICE	MEDICION 1-B	IRENE LIRIO
22569	5 KG. RICE	BUCANDALA 4	KAREN LACUTAB

Figure 16. Sample monthly draw winners of BasuRaffle

Income for the community

The economic benefits of this initiative are the prizes that the winners will get from the monthly and grand raffle draws. Prizes at stake during monthly draws are stand fans, desk fans, double burner gas stove, rice cooker, oven toaster, flat iron, electric kettle, single burner gas stove and five kilograms of rice for five winners. For the grand draw, different home appliances like television set and refrigerators are at stake. Figure 16 shows the monthly winners of the September 2021 draw as posted in the Facebook Page of CENRO Imus. In addition, incentives like monoblock chairs/tables and television sets are also given to barangays depending on the number of kilograms of plastic waste collected.

Measurable impacts

According to the official website of the City of Imus, on April 22, 2020, the participation of different barangays and public schools in the city in the BasuRaffle initiative was able to recover 22,637 kg of plastic residual waste. Moreover, 87,959 or 80.87% of households in the city are compliant to waste segregation based on the first quarter 2019 data, and the level of compliance increased to 82% by second quarter of 2019.

In addition, according to the official website of the City of Imus, on January 20, 2021, the plastics collected from the BasuRaffle are segregated first before they were brought to the waste disposal facility. Biodegradable wastes are brought to the composting facilities in Barangay Malagasang 1-A and to the Ecology Center at Barangay Buhay na Tubig. Collected plastic wrappers from different factories are converted into eco-bricks, bayong, wallets, all part of the recycling project and livelihood program of Imus City.

And finally, the Local Government Unit (LGU) of Imus received awards (Figure 17) for their efforts and initiatives for a clean environment:

1. 2016 LGU Awardee for Exemplary Practice in the Implementation of the Different Environmental Mandates CALABARZON Region
2. 2017 LGU Awardee for Exemplary Practice in the Implementation of RA 9003 using Best Environmental Technology Available and Best Available Practice
3. 2018 LGU Implementing Significant Innovations on Ecological Solid Waste Management
4. 2019 Top One in LGU Compliance Assessment for the Manila Bay Clean Up
5. 2019 Platinum Awardee on Environmental Compliance Audit (ECA)



Figure 17. City environmental awards for 2016-2018 (top) and for 2019 (bottom)

War on Waste: Plastic Bottle Mo, I-shoot Mo!

This is an individual initiative of Ms. Rhodora Sacramento, Principal of Real Elementary School, Bacoor City, Cavite. The War on Waste (WOW) Project started in 2016 when Ms. Rhodora Sacramento was still Principal of Salinas Elementary School, a public school in Salinas, Bacoor. When she was transferred to Real Elementary School (RES) in Salinas Bacoor in July 2018, she continued the initiative and relaunched it in 2019.

The objectives of the WOW project are as follows:

1. Minimize the number of garbage bags collected from 1000 bags to 500 bags
2. Practice proper waste segregation in every day.
3. Create awareness about environment conservation.
4. Develop “makakalikasan” (value for environment) habit

The WOW initiative is composed of three activities: 1) Plastic Bottle Mo, I Shoot Mo, 2) Plastic Wrapper Turned into Brick and 3) *Kanya-kanyang Basurahan (Ecobag) Ilagay sa Tamang Lalagyan* (have your own bag for your own trash)

Self-sustaining circular system

The collected plastic bottles filled with shredded candy wrappers for the *Plastic Wrapper Turned into Brick* activity are handed over to Robinson Hyper Mart Bacoor. Robinsons Easymart, in partnership with The Plastic Solution, forged a project called #EasyOnThePlastic aiming to build homes for the Yangil tribe of Zambales using ecobricks.

Jody Gadia, the General Manager of Robinsons Supermarket Corporation stated in the official website of Robinsons Retail Holdings, Inc.:

“We’re happy that we are able to use our platform as a modern retailer to support the endeavor. Diverting plastic waste from landfills and waterways and transforming it into homes, this was an avenue for Robinsons Easymart to foster long-term positive impact for Filipino families. Our thrust has always been to advocate a healthy lifestyle among our customers, and this can extend to social involvement and taking care of the environment as well. We understand that business is always connected to the state of the people and planet.”

Appropriate technology and local capacity

Each of the three activities of WOW has its own procedures and mechanics. For the Plastic Bottle Mo, I Shoot Mo, Grades 4 to 6 pupils are encouraged to carry and shoot their plastic bottles in an MRF that looks like a basketball bin. A team of students were also created to monitor and evaluate the activity. Every last Friday of the month, the school coordinates with a junk shop to remove the plastic bottles and weigh them. The team assigned to monitor and evaluate the activity records the weight of the plastics and temporarily keep them inside the school's stockroom. Junk shops accredited by the school collect the plastics according to an agreed schedule.

For the *Plastic Wrapper Turned into Brick* activity, students are asked to bring empty one-liter plastic soft drinks bottle. The teacher will mark the starting date in the bottle for reference. Students will collect empty candy wrappers and put it in their ecobag. Every Saturday, the students shred the collected wrappers into small pieces and insert them inside their plastic bottles. The students will bring the full bottle of cut candy wrappers to school every Thursday. Every Friday, the school guard will transport the collected plastic bottles to Robinson Hyper Mart in Bacoar in exchange for ecobags made of "katsa" (canvass cloth). The canvass ecobag will be given to the student who brought the plastic bottle.



Figure 18. "**Kanya-kanyang basurahan, ilagay sa tamang lagayan**" waste segregation activity (Photo from Ms. Rhodora Sacramento)

For the *Kanya-kanyang Basurahan (Ecobag) Ilagay sa Tamang Lalagyan* activity, every student bring their ecobag inside the classroom and put all their plastic wrappers and paper inside it (Figure 18). During dismissal time, the students segregate their trash and put it in the correct trash bin. The class leaders supervise and record students who do not follow the activity and report to the class adviser. Following lunch time, all left-over foods are placed in biodegradable trash bins and are disposed of at the school poultry (chicken yard).

Community commitment and partnerships

The WOW project is part of the five-year school improvement plan of the school. The duration of this project is from September 2018 to September 2022. The implementation is in coordination with the Youth for Environment in School Organization (YES-O), a student organization that advocates the protection of the environment and the General Parents-Teachers Association (GPTA), the parents-teacher association of the school.

According to the school's principal, as a science teacher, she has this moral obligation to teach the students save the environment from further destruction by integrating different environmental measures. She emphasizes in her lessons that if the environment will be destroyed by the garbage that people throw anywhere, the future generation will also suffer.

The project's success is due in part to the active participation and cooperation of the 790 students, 25 teachers and GPTA officers of Real Elementary School.



(Photo from Robinsons Retail Holdings, Inc. webpage)

Figure 19. Sample plastic bottles turned over to Robinson's Hypermart

The cooperation of the students, teachers and parents is further concretized by the collective funds they generated for the construction of the basketball bin for the Plastic Bottle Mo, I Shoot Mo activity. The PHP 7,000.00 budget used to construct the bin came from the fund-raising projects of GPTA. This amount was used to buy the steel bars, to rent for the welding machine and to purchase the paint used for the basketball bin. Labor is free since the GPTA officers volunteered to make the bin. As for the teachers, they oversee the monitoring and evaluation of the project every quarter.

In addition, RES also has a partnership with Robinson Hyper Mart in Bacoar for the Plastic Wrapper Turned into Brick activity (Figure 19). Robinson Hyper Mart is part of the Robinsons Retail Holdings, Inc. (RRHI), one of the Philippines' largest and most diverse multifunctional retailers.

Enhanced community knowledge

To raise the level of awareness among students on waste management, the following activities were implemented by RES:

- Integration of waste management in the curriculum
- Following the mandate of the Department of Education (DepEd) to practice environment friendly measures within school premises
- Living out DepEd's core values of Maka Diyos (love for God), Maka Kalikasan (love for nature), and Maka Bansa (love for country)
- Application of waste segregation at home (students take videos of their waste segregation practice at home) with the supervision of the students' parents
- Values formation on how to take care of the environment in the Edukasyon sa Pagpapakatao (ESP) subject
- Use of the school's bulletin boards for the awareness of the project.

Income for the community

According to Ms. Rhodora Sacramento, the proceeds of the Plastic Bottle Mo, I Shoot Mo activity goes to YES-O. The organization was able to collect PHP 2,500 for three

months and the money was used by the organization for their Christmas party. For the Plastic Wrapper Turned into Brick activity, Robinson Hyper Mart gives one katsa (canvass cloth) ecobag for every four bottles of soft drinks filled with cut candy wrappers. There is no income generated for the Kanya-kanyang Basurahan (Ecobag) Ilagay sa Tamang Lalagyan activity since the focus of this activity is more on waste segregation to maintain the cleanliness of the school and to promote environmental awareness actions among students.

To further motivate students to maintain cleanliness in their classrooms, certificate of recognition and prizes were also awarded to the cleanest room at the end of the school year.

Measurable impacts

Ms. Sacramento proudly said that the number of garbage bags collected every Wednesday was reduced from 20 garbage bags to five garbage bags due to this activity. Before the program, they employed two school janitors with a monthly salary of PHP7,000.00 charged to the school's budget. Because of this project they no longer hire janitors (zero janitor) to maintain the cleanliness of the school premises. They were able to save PHP14,000.00/month because of this project.

Summary

The survey revealed the inadequacy of awareness of community people regarding initiatives that their own LGUs are undertaking to mitigate plastic waste pollution. With barely a third able to respond positively that they know of an initiative, what this third knows is almost entirely limited to clean-ups. This is a far cry from the pronouncements of environmental administrators who enumerated notable programs well-funded by the government. This led to the search of a model in plastic waste mitigation that capture the criteria of what makes an initiative "best". The Wangwa Management Model of Thailand was adopted as its indicators are applicable to the initiatives offered by administrators in the key informant interviews (Table 13).

Table 13. Best Initiatives in a nutshell

Waste Management Indicators (Wangwa)	Waste to Ecobricks Technology	BasuRaffle	War on Waste
Self-sustaining circular system	The ecobricks were used in the landscaping of ecogardens in different barangays in Silang and in the construction of barangay halls, health clinics and day care centers.	The collected plastic residuals are turned over to the Villar Foundation's recycling facility in Las Piñas to be converted into armchairs.	Robinsons Easymart in partnership with The Plastic Solution through a project called #EasyOnThePlastic, used the ecobricks as a material to build homes for the Yangil tribe of Zambales.
Appropriate technology and local capacity	Produced are two types of ecobricks, the ecobricks for walls and plastic ecobricks for pathways.	One kilogram of plastic residuals is equivalent to one raffle ticket.	Materials Recovery Facility (MRF) that looks like a basketball ring allows children and teachers to have fun shooting plastic bottles.
Community commitment and partnerships	Community partnership between MENRO Silang and different barangays are forged	CENRO Imus being the main implementor of this initiative, coordinates with the different barangay captains.	Active participation and cooperation of the 790 students, 25 teachers and GPTA officers of Real Elementary School and partnership with Robinsons Easymart are achieved.
Enhanced community knowledge	MENRO Silang official Facebook Page and Information Education Campaign (IEC) help in IEC dissemination.	CENRO Imus official Facebook Page and Imus City Government official website help in IEC dissemination.	Integration of waste management in the curriculum ensure that children learn about it.
Income for the community	"Plastic Mo Palit bigas Program" gives the residents of the barangay one kilogram of rice in exchange for a kilogram of plastic.	Prizes are given to winners of the monthly and grand raffle draws.	The proceeds of the plastic waste were used by the organization for their simple Christmas party.
Measurable impacts	Before the ecobricks program, the volume of waste they collect per day is twelve trucks. But after the implementation of this program, the volume of waste collected per day were reduced to eight trucks.	The BasuRaffle initiative was able to collect 22,637 kg of plastic residual waste from participation of different barangays and public schools in the city.	The number of garbage bags collected by the barangay garbage collector every Wednesday was reduced from 20 garbage bags to 5 garbage bags because of this activity.

COST-BENEFIT ANALYSES

This section, contingent to the earlier identified top initiatives to address plastic pollution and leakage to the river, investigates their cost-benefit aspect. The goal is to look at the impact of the said initiatives, particularly on curbing plastic wastes problem in the province. This is based on the benefits that these initiatives brought to the community or environment, vis-a-vis the cost incurred in their operations. In addition, it also seeks to use a framework of analysis that is appropriate given the limitations of the gathering process and the available data for disposal.

Cost-Benefit Framework of Analysis

Analysis of incurred costs and benefits derived from a plastic waste management program is one of the ways to determine the operational and economical profitability of the program. The program is operationally profitable when the revenues generated by the program is greater than the costs of inputs used. It is economically profitable when revenues generated is greater than the total of costs of inputs used and opportunity costs. This analysis aims to help policymakers and project implementors in the evaluation of the existing plastic waste management programs. The result of evaluation can be used as a guide in deciding to continue, replicate, improve or abandon a program.

The cost-benefit analysis of the identified best practices is based on the methodology used by Medina-Mijangos *et al.* (2021) in a study that aims to perform an economic analysis of a light packaging and bulky waste sorting treatment facility in Gavà-Viladecans, Barcelona, Spain. The study measures Private Benefit (B_P) as well as Total Benefit (B_T) derived from operating the treatment facility. B_P is derived by comparing the annual sales revenue from the volume of wastes sold to the total costs incurred from the operations. Total costs include investment costs, operational and maintenance costs, financial costs, and taxes. The investment costs represent one-year depreciation of the capital expenditures while financial costs are interests incurred on loans obtained to finance the operations. B_T is equal to B_P plus the value of the positive externalities less both the value of negative externalities and opportunity costs. Externalities include the avoided material sent to landfills, the guarantee of supply of material, quality of material, avoided emissions to air and water, physical and chemical risks, a culture of reduction, use and recycling of wastes, improved technique of workers, and disamenities. The opportunity cost is the amount of income that would have been earned by the entity if the capital and reserves were invested in a financial instrument. The study includes sensitivity analysis for two variables: 1) revenue received from light packaging sorting services

and 2) opportunity costs. The methodology focuses on a specific operating year. The value of B_P and B_T is used to assess if the project is operationally (OP) and economically (EP) profitable. If B_P is equal to or less than zero, then the project is not operationally profitable (NOP). If B_T is equal to or less than zero, then the project is not economically profitable (NEP).

In this study, B_P refers to the operational profit which is the difference between the total revenues and costs of inputs used. Total revenues include the annual revenue derived from the sale of plastic waste to junkshops, the deemed sale of the ecobricks, averted landfill cost, and other cost savings. Averted landfill cost which is common to all three practices is determined by multiplying the weight (kg) of plastic waste collected by the cost of dumping waste to landfill estimated at PHP1.60/kg. Investment costs, operational and maintenance costs, financial costs, and taxes compose the total costs. Investment costs represent one-year depreciation of the property and equipment used by the plastic waste management program. The depreciation is determined using the straight-line method. The estimated useful life of the property and equipment is based on the Table of Estimated Useful Life of Property, Plant and Equipment for Philippine Government. Operational and maintenance costs include IEC costs, personnel costs, production costs, utilities, and other expenses. No financial cost is included in the analysis since the programs are fully funded by the government. As such, no debt was incurred in the implementation of these programs. Since these are government programs, no taxes are charged on the income earned by the program. The analysis focuses on a specific operating year, i.e. 2019 for War on Waste and BasuRaffle; and 2020 for Waste to Ecobricks Technology. The choice of the specific operating year as the focus of the analysis is based on data limitation. B_T of the identified practice refers to the economic profit which is derived by deducting from the revenues the cost of all inputs used as well as the opportunity costs. B_T is B_P less opportunity costs. Due to data limitation, positive and negative externalities were excluded in the B_T computation. The values of B_P and B_T were used to assess if the program is operationally (OP) and economically (EP) profitable. If B_P is equal to or less than zero, then the project is not operationally profitable (NOP). If B_T is equal to or less than zero, then the project is not economically profitable (NEP).

The sensitivity analysis focuses on revenue and opportunity costs. The previous study on the evaluation of benefits and costs of managing wastewater and solid waste management at Citrum River in West Java, Indonesia, Kerstens *et al.* (2016) considered in the sensitivity analysis the reduction of the selling price of the recovered resources to 50% of the baseline value. This approach is adopted in the sensitivity analysis for programs with sales revenue (Waste to Ecobricks Technology and War on Waste: Plastic Bottle Mo, I-shoot Mo!). The opportunity costs represent

the amount that would have been earned by the program if the capital expenditures were invested in the Philippine Government Bonds. The interest rates on Philippine Government Bonds are 3.688% for five years and 5.983% for 10 years. For assets with an estimated useful life of more than five years but less than 10 years, opportunity cost is determined using the interest rate of 3.688%. Since B_T for War on Waste is positive, sensitivity analysis for this program includes the determination of the level of plastic bottles collection when the practice becomes unprofitable (B_T becomes negative). B_T for both the BasuRaffle and Waste to Ecobricks Technology is negative, thus, sensitivity analysis for these programs included the determination of activity levels when the program becomes operationally and economically profitable. This study also determines the benefit-cost ratio (BCR) for each program.

Waste to Ecobricks Technology

Total revenues for this program comprise of the revenue from the deemed sale of eco-bricks, averted landfill cost, and cost saved from the purchase of cement bags. In 2020, total revenue is estimated at PHP227,836.36. During this year, it was estimated that MRF Silang produced and released 8,750 eco-bricks which can be sold at PHP22 per piece resulting in sales revenue of PHP192,500. Production of these bricks used 397.73 kg of plastic waste. During this year, Republic Cement collected 2,000 kg of shredded plastic waste in exchange for 140 cement bags selling at PHP225 per bag. Through this program, the amount of plastic waste which was reused and did not end in the landfill is 2,397.73 kg equivalent to a total cost savings of PHP3,836.36 based on PHP1.60 averted landfill cost per kilogram.

Total costs for 2020 is estimated at PHP349,737.66 consisting of investment costs and operational and maintenance costs. There are 3 products produced by the MRF facility – eco-bricks, plastic bricks, and organic composts. Common costs incurred in producing these products are allocated based on the workload distribution (WLD): 50% eco-bricks, 25% plastic bricks, and 25% organic composts. Investment costs amounting to PHP53,080 pertain to the depreciation of the equipment used to produce eco-bricks and 50% of the depreciation for the MRF building. Operational and maintenance costs include the cost of producing the eco-bricks, 50% of the supervisory costs and utilities and other expenses incurred. The cost of sand, cement, gravita, water, electricity and direct labor used to produce one eco-brick is estimated at PHP8.49. Supervisory cost and utilities and other expenses allocated to eco-bricks production are estimated at PHP192,348 and PHP30,000, respectively. The analysis shows that B_P for this program is estimated at – PHP121,901.30 which means that the program is not operationally profitable.

Table 14. Cost-benefit analysis for Waste to Ecobricks Technology

Scenarios	WLD: 50%			WLD: 50%			WLD:75%	WLD: 75%
	selling price per brick: PHP22			selling price per brick: PHP11			selling price per brick: PHP22	selling price per brick: PHP22
							B _T = 0	B _T > 0
# of bricks produced	8,750.00	17,319.00	21,120.00	8,750.00	17,319.00	21,120.00	38,508	38,510
Production capacity	41%	82%	100%	41%	82%	100%	182%	182%
Annual revenue from sales	192,500.00	232,320.00	325,248.00	96,250.00	116,160.00	162,624.00	847,178.17	847,220.00
Averted landfill cost	3,836.36	3,968.00	4,275.20	3,836.36	3,968.00	4,275.20	6,280.65	6,280.65
Other cost savings	31,500.00	31,500.00	31,500.00	31,500.00	31,500.00	31,500.00	31,500.00	31,500.00
Total	227,836.36	267,788.00	361,023.20	131,586.36	151,628.00	198,399.20	884,958.82	885,000.65
Investment costs	53,080.00	53,080.00	53,080.00	53,080.00	53,080.00	53,080.00	65,580.00	65,580.00
Operational and maintenance costs	296,657.66	399,430.17	444,881.02	296,657.66	399,430.17	444,881.02	725,211.86	725,211.87
Financial costs	-	-	-	-	-	-	-	-
Taxes	-	-	-	-	-	-	-	-
Total	349,737.66	425,510.17	497,961.02	349,737.66	452,510.17	497,961.02	790,791.86	790,791.87
B _P	(121,901.30)	(184,722.17)	(136,937.82)	(218,151.30)	(300,882.17)	(299,561.82)	94,166.96	94,208.78
Opportunity costs	94,166.96	94,166.96	94,166.96	94,166.96	94,166.96	94,166.96	94,166.96	94,166.96
B _T	(216,068.26)	(278,889.13)	(231,104.78)	(312,318.26)	(395,049.13)	(393,728.78)	-	41.82
BCR	0.51	0.49	0.61	0.30	0.28	0.34	1.00	1.00
Interpretation	NOP	NOP	NOP	NOP	NOP	NOP	OP	OP
	NEP	NEP	NEP	NEP	NEP	NEP	NEP	EP

(B_P = Revenues – Cost of Inputs Used; B_T = B_P - Opportunity Cost; OP if B_P > 0; EP if B_T > 0)

Sensitivity Analysis

The sensitivity analysis determines the effect on the benefits derived from the practice by the changes in revenues and costs. The changes are: (1) the inclusion of

opportunity cost; (2) reduction of the deemed selling price of the eco-bricks by 50%; and (3) increase in the number of units produced and sold. Increase in the number of units produced requires an increase in the production capacity. The inclusion of opportunity cost and the reduction in the selling price to half are based on the previous research on plastic/solid waste management. This study aims to determine the level at which the benefits will equal costs as well as the level when benefits outweigh the costs. The current production capacity based on WLD of 50% is 41% and results to a negative B_P and B_T of PHP121,901.30 and PHP216,068.26, respectively. Thus, the sensitivity analysis included determination of B_P and B_T when the current production capacity is doubled (82%) and when it is increased to 100%. Since the resulting B_P and B_T are still negative even when the production capacity is doubled or utilized in full, it can be concluded that the levels at which B_T equals to or is greater than zero is achieved by increasing the number of units produced and sold.

At current selling price of PHP22 per ecobrick, if the production capacity is doubled or fully utilized, the resulting B_T is -PHP278,889.13 and -PHP231,104.78, respectively. At current production capacity of 8,750 ecobricks, if the deemed selling price per brick is reduced by half, B_T is - PHP312,318.26. At 82% and 100% production capacity, when selling price per ecobrick is at PHP11, the resulting B_T further dropped to - PHP395,049.13 and -PHP393,728.78, respectively. With a negative B_T , the program is not economically profitable even when the production capacity is doubled or fully utilized. The program becomes operationally but not economically profitable when the facility produced and sold 38,508 bricks at a selling price of PHP22. This level of production requires an additional 25% WLD. Producing ecobricks beyond 38,508 units results in the program being operationally and economically profitable. Thus, this program can be continued if it can produce and sell at least 38,508 ecobricks (Table 14).

BasuRaffle

In 2019, 74,333 kg of plastic wastes were collected through the BasuRaffle program which was collected and used by Cemex. Total revenue for this program consists only of the averted landfill cost amounting to PHP118,932.80.

Investment costs and operational and maintenance costs comprise the total costs incurred by the program to determine B_P . The estimated annual depreciation for the mini dumper used by the program in collecting plastic wastes from the barangays amounting to PHP25,714.29 represents the investment cost. This is equivalent to 20% of the annual depreciation of the mini dumper as the program utilizes only one day per week to collect plastic wastes for BasuRaffle. The operational and

maintenance costs of PHP350,663.80 include the cost of tarpaulins used by the barangay to promote the program, cost of raffle prizes, 20% of the salaries of the truck driver and two to three eco aides, gas and oil used by the mini dumper, and snacks given to plastic wastes collectors from Cemex. The tarpaulins cost PHP46,560. Raffle prizes of P15,000 each month were given. The average annual salaries for the driver and eco aides are estimated at PHP105,003.80 while the estimated amount of gas/oil and of the snacks incurred during 2019 are PHP9,100 and P10,000, respectively.

Comparing the total revenues of PHP118,932.80 with the total costs of PHP376,378.09, B_P is estimated at - PHP257,445.29 which implies that the program is not operationally profitable.

Table 15. Cost-benefit analysis for BasuRaffle

Scenarios	1-day collection for 74,333 kg and below			2 days collection	2 days collection
	2 days collection for 148,666 kg			$B_T = 0$	$B_T > 0$
Kg of plastic wastes collected	74,333.00	37,166.50	148,666.00	367,764.58	368,212.00
Annual revenue from sales	-	-	-	-	-
Averted landfill cost	118,932.80	59,466.40	237,865.60	588,423.33	589,139.20
Other cost savings	-	-	-	-	-
Total	118,932.80	59,466.40	237,865.60	588,423.33	589,139.20
Investment costs	25,714.29	25,714.29	51,428.57	51,428.57	51,428.57
Operational and maintenance costs	350,663.80	345,863.80	474,767.60	503,802.88	498,767.60
Financial costs	-	-	-	-	-
Taxes	-	-	-	-	-
Total	376,378.09	371,578.09	526,196.17	555,231.45	550,196.17
B_P	(257,445.29)	(312,111.69)	(288,330.57)	33,191.88	38,943.03
Opportunity costs	33,192.00	33,192.00	33,192.00	33,192.00	33,192.00
B_T	(290,637.29)	(345,303.69)	(321,522.57)	(0.12)	5,751.03
BCR	0.29	0.15	0.43	1.00	1.01
Interpretation	NOP	NOP	NOP	OP	OP
	NEP	NEP	NEP	NEP	EP

(B_P = Revenues – Cost of Inputs Used; B_T = B_P - Opportunity Cost; OP if $B_P > 0$; EP if $B_T > 0$)

Sensitivity Analysis

The only source of revenue for this practice is the averted landfill cost which is directly affected by the volume of plastic wastes collected. Aside from the inclusion of opportunity cost, the sensitivity analysis for this program also determined the B_P and B_T when the volume of plastic wastes collected is reduced to half or is doubled. Since the resulting B_P and B_T are negative even when the volume of plastic wastes collected was doubled, this study also aims to determine the volume of plastic wastes collected at which B_T equals to and is greater than zero. At these levels, B_P is expected to have a positive value.

If opportunity cost of PHP33,192.00 was included in the computation, the resulting B_T is estimated at - PHP290,637.29 indicating that the program is not economically profitable. The opportunity cost represents the amount of interest that the program may have received if it invested the capital expenditure used to purchase the mini dumper in government bonds that pay an annual interest of 3.688%.

When the volume of plastic wastes collected was reduced to 37,166.50 kg, the value of B_P and B_T further decreased to -PHP312,111.69 and -PHP345,303.69, respectively. B_P and B_T remained at negative levels even when the volume of plastic wastes collected was doubled from 74,333 kg to 148,666 kg. When volume of collection was doubled, the number of days used to collect plastic wastes was increased to 2 days. Such increase in collection days results to an increase in investment cost and operational and maintenance costs.

B_T is approximately equal to zero when the volume of plastic waste collected was increased to 367,764.58 kg. This is equal to an average of 72.91 kg per week of waste collected from each of the 97 barangays. This program may be continued if average volume of plastic wastes collected from each barangay is 73 kg per week (or a total of 368,212 kg) since this collection rate will yield to a positive B_P and B_T (Table 15).

War on Waste

The War on Waste project that an individual, in the person of Rhodora Sacramento of Bacoar City, a school principal, advanced in her community is considered a simple yet a practical move to address the looming problem of plastic waste in the area. Armed with just her will and her ingenuity, she managed to contribute to of the solution to the plastic litter problem in her school while at the same time minimizing the cost of operations incurred in the school.

Total revenues for this practice consist of the annual revenue from the sale of plastic bottles to junkshops set at PHP10/kg, averted landfill cost, and other cost savings. In 2019, the school was able to collect 250 kg of plastic bottles for three months. This volume was annualized using an estimated number of three quarters in one school year. Thus, the annual revenue from the sale of plastic bottles was estimated at PHP7,500. The averted landfill cost of PHP1,200.00 was also based on the annualized volume of plastic bottles collected, i.e., 750 kg, multiplied by the estimated averted landfill cost per kilogram of PHP1.60. Other cost savings of PHP17,800 represent 10% of the annual salary and Christmas gift given to two janitors. Through the comprehensive War on Waste program, the cleanliness and orderliness of the school were maintained even without employing the services of janitors. It was estimated that 10% of the workload of the janitors was reduced through the Plastic Bottle Mo, I-shoot Mo! program. The total annualized revenue generated by this practice is PHP26,500.

The cost of operating this program consists only of investment costs. Investment costs represent the annual depreciation of the plastic bottle bin, which was fabricated at a total cost of PHP7,000. With a 790-student population and an average collection rate of 0.95 kg of plastic bottle waste per student, B_P is estimated at PHP25,100.00 which means that the program is operationally profitable.

Sensitivity Analysis

The opportunity costs represent the amount of interest that the program may have received if it invested the PHP7,000 cost of fabricating the plastic bottle bin in government bonds that pay an annual interest of 3.688%. Including an opportunity cost estimated at PHP258.16, B_T was estimated at PHP24,841.84 indicating that program is economically profitable.

This study also aims to determine the impact on B_P and B_T when the student population is decreased by half or is doubled and when the selling price per kilogram of plastic bottle waste is reduced from PHP10 to PHP5. Using an average collection rate of 0.95 kg of plastic bottle waste per student, even if the student population was reduced by half, the resulting B_P and B_T remained at positive levels. If the student population is doubled, i.e., from 790 to 1,580, B_P and B_T are expected at positive levels. This remains to be the case even when the selling price of plastic bottles to junkshops drops to PHP5.

The sensitivity analysis includes the determination of a scenario that will result to a negative B_P and B_T . The investigation shows that B_P and B_T become negative when the

average collection rate per student is at 0.05 kg, janitorial cost allocation is at 0.20%, and selling price is at PHP5 per kilogram (Table 16).

Table 16. Cost-benefit analysis for War on Waste

Scenarios	Collection rate: 0.95 kg per student			Collection rate: 0.95 kg per student			Collection rate: 0.05 kg per student		
	Janitorial cost allocation: 10%			Janitorial cost allocation: 10%			Janitorial cost allocation: 0.20%		
	Selling price per kg: PHP10			Selling price per kg: PHP5			Selling price per kg: PHP5		
Student Population	790	395	1,580	790	395	1,580	790	395	1,580
Annual revenue from sales	7,500.00	3,750.00	15,000.00	3,750.00	1,875.00	7,500.00	197.50	98.75	395.00
Averted landfill cost	1,200.00	600.00	2,400.00	1,200.00	600.00	2,400.00	63.20	31.60	126.40
Other cost savings	17,800.00	8,900.00	35,600.00	17,800.00	8,900.00	35,600.00	356.00	178.00	712.00
Total	26,500.00	13,250.00	53,000.00	22,750.00	11,375.00	45,500.00	616.70	308.35	1,233.40
Investment costs	1,400.00	1,400.00	2,800.00	1,400.00	1,400.00	2,800.00	1,400.00	1,400.00	2,800.00
Operational and maintenance costs	-	-	-	-	-	-	-	-	-
Financial costs	-	-	-	-	-	-	-	-	-
Taxes	-	-	-	-	-	-	-	-	-
Total	1,400.00	1,400.00	2,800.00	1,400.00	1,400.00	2,800.00	1,400.00	1,400.00	2,800.00
B _P	25,100.00	11,850.00	50,200.00	21,350.00	9,975.00	42,700.00	(783.30)	(1,091.65)	(1,566.60)
Opportunity costs	258.16	258.16	516.32	258.16	258.16	516.32	258.16	258.16	516.32
B _T	24,841.84	11,591.84	49,683.68	21,091.84	9,716.84	42,183.68	(1,041.46)	(1,349.81)	(2,082.92)
BCR	15.98	7.99	15.98	13.72	6.86	13.72	0.37	0.19	0.37
Interpretation	OP	OP	OP	OP	OP	OP	NOP	NOP	NOP
	EP	EP	EP	EP	EP	EP	NEP	NEP	NEP

(B_P = Revenues – Cost of Inputs Used; B_T = B_P - Opportunity Cost; OP if B_P > 0; EP if B_T > 0)

Thus, in this context, the benefits far outweigh the cost in the operation of the project on waste in the school community. This means that the initiative is not only cost-effective and financially sustainable but also helps in curbing plastic waste in the sphere of Ms. Sacramento's influence.

Summary

This part aims to investigate the economical profitability of the identified best initiatives, particularly on curbing plastic wastes problem in the province on the basis of the benefits that these initiatives have brought to the community or environment, vis-a-vis the cost incurred in their operations.

Table 17. Cost and benefits from operations of identified best practices

Actual results of operations	Waste to Ecobricks Technology 8,750 bricks @PHP22/pc	BasuRaffle 74,333 kg of plastic wastes	War on Waste 750 kg @PHP10/kg
Revenues	227,836.36	118,932.80	26,500.00
Costs	(349,737.66)	(376,378.09)	(1,400.00)
B _P	(121,901.30)	(257,445.29)	25,100.00
Opportunity costs	(94,166.96)	(33,192.00)	258.16
B _T	(216,068.26)	(290,637.29)	24,841.84
Averted plastic wastes in kg (cost@PHP1.60/kg)	5,200.00	74,333.00	750.00

Projections to achieve positive B _T	Waste to Ecobricks Technology 38,510 bricks @PHP22/pc	BasuRaffle 368,212 kg of plastic wastes
Revenues	885,000.65	589,139.20
Costs	(790,791.87)	(550,196.17)
B _P	94,208.78	38,943.03
Opportunity costs	(94,166.96)	(33,192.00)
B _T	41.82	5,751.03
Averted plastic wastes in kg (cost@PHP1.60/kg)	3,925.00	368,212.00

The result of the cost-benefit analysis (Table 17) shows that the costs incurred in operating the Ecobricks technology as well as the BasuRaffle exceed the benefits derived from such programs. To attain economic profitability, it is recommended that the Ecobrick technology must produce at least 38,510 ecobricks per year while the BasuRaffle collect at least 368,212 kg of plastic wastes a year or an average of 73 kg per barangay per week.

The benefits derived from the War on Waste program outweighs its costs, which makes the program operationally and economically profitable. Other schools can

adopt the War on Waste program even if their student population is only half of 790, if the schools require an average collection rate of 0.95 kg of plastic bottle waste per student.

The focus on the operational and economical profitability is an attempt to quantify the costs and benefits of the best initiatives. This corresponds to what Kee (2005) calls *tangible benefits and costs*: those that can readily be monetized or have an approximate valuation. Kee, however, includes *intangible benefits and costs*: those that cannot be priced or have monetary value. In the previous chapter, the adoption of the Wangwa Model has identified these intangible benefits. To wit, some of the unquantifiable benefits derived from the initiatives covered by the present study are 1) barangay officials' consistent undertaking of river clean-ups without additional incentives, 2) forged collaboration of local officials with environmental advocates, 3) increased awareness of different ways to give plastic a second life, and 4) strengthened concern for the environment through curricular and extra-curricular activities.

Apparently, the three identified best practices do not have financial plans. A financial plan might not be expected for the War on Waste program since this is personally initiated by an individual and involves only a minimal amount of investment. However, for the Ecobricks technology and BasuRaffle programs, which involved a relatively substantial amount of investment and operational and maintenance costs, a financial plan as well as its periodic monitoring and evaluation are a must.

A financial plan provides quantitative information that determines the feasibility of a program, an important aspect that must be considered in deciding whether to implement such a program. Once the program is implemented, a financial plan also helps in monitoring and evaluating the actual performance and provides a basis for corrective actions when targets are not reached. A financial plan also ensures that enough funds are allocated for the program.

Monitoring and evaluation of a financial plan requires the collection, storage, and processing of financial data that allow timely reporting of the actual performance. An information system must be in place to make the financial data available when needed.

LOCAL MEANING-MAKING

The Culture of 'Tingi' and the Use of Plastic

In the Filipino context, “tingi” may be described as a piecemeal action or anything that quickly gratifies the actor or recipient. By extension, “tingi” culture refers to the penchant of Filipinos to do things in small parts, give something in bits and pieces, or more popularly, buy products in tiny individual packages, and hence, in this case, it corresponds to what is universally known as the *sachet culture*.

In 2004, CK Prahalad, an economist extolled the value of sachet packaging in his opus, *The Fortune at the Bottom of the Pyramid: Eradicating Poverty through Profits*. The book conveys the thesis that sachet packaging of household products, such as coffee, shampoo, toothpaste, powdered juice and conditioner among others, enables the global poor to procure goods that well-off people consume, albeit in small amounts. Instead of the more expensive bottle of shampoo, can of milk, or any other goods in large containers typically found in grocery stores in developed countries, the use of sachet packaging makes sound economic sense. Profit can still be made from the bottom of the pyramid (BoP) by making quality goods affordable via sachet packaging.

Locally, *tingi*, or *tingi-tingi* is pervasive in the Philippine retail industry. It fits the way of life of the common Filipino, especially the minimum wage workers (P303.00 - 400.00 in Cavite for 2021) on the premise that based on their earnings, sachets of common household products enable them to maximize their limited budget, although they might need to buy goods more often.

In this study, part V of the survey questionnaire tackles the preponderant preference to sachets over big bulk of many Filipinos when buying. This part begins with inquiry into the respondents' usage of products packaged in single use sachets or plastic bag.

Frequency of Plastic Use

Several questions were asked to explore the respondents' plastic use. More than half (52%) rated their usage of plastic as “often” (2-6 times/week) while about two in 10 each admit to using it “always” (everyday) and “seldom” (0-1 time/week) (Figure 20).

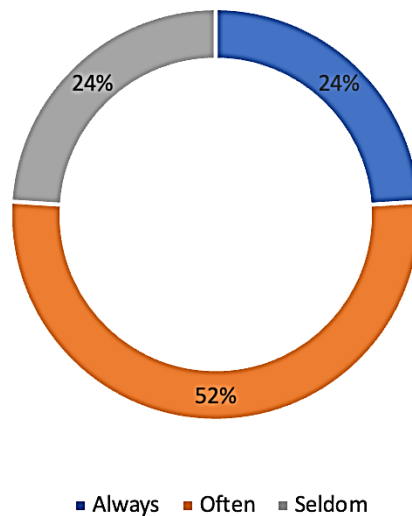


Figure 20. Frequency of plastic use

Source of Plastic

When asked about the source of plastic the respondents used, they pointed to the ubiquitous sari-sari store as the most common source, followed closely by the wet market, and lastly by malls and big grocery stores (Figure 21).

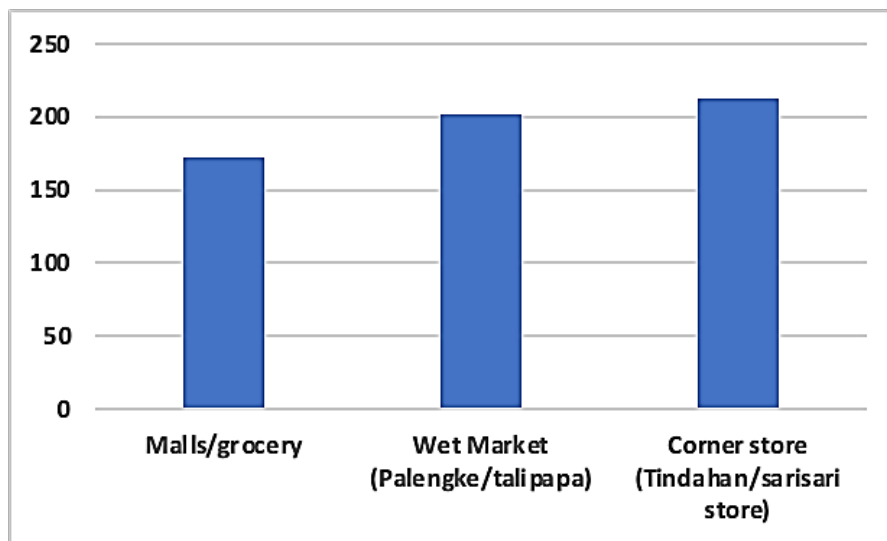
Casual conversations with sari-sari store helpers, however, point out that purchase of goods in sachet or plastic packaging, including the use of the plastic “labo” (HD bag) is very prevalent, and hence, the survey results might be an underestimate.



From left to right: HD plastic bag (LM) is used commonly as carrier bag (L) even when paper is used as wrapper (R) as it gets torn easily (RM).

Breakfast for Filipinos typically include freshly baked “pandesal” in a neighborhood bakery. Because the bread is still hot, brown paper is used as wrapper, after which it

is placed inside plastic “labo” so it can be securely carried home, otherwise, the moisture coming from the heat will easily tear the paper.



**Multiple responses*

Figure 21. Source of plastic wastes

Filipinos readily turn to the “sari-sari” store for their daily needs even when the more established convenience stores are a stone’s throw away. A “sari-sari” (literally means variety/different kinds) store is a small neighborhood retail shop that sells goods based on consumer demand and thus, it usually carries basic items such as canned food, instant noodles, coffee, soda, and other things that Filipinos use and consume daily. These goods are mostly considered fast moving consumer goods (FMCGs) because their contents are enough for single use, and thus, prices are within the people’s daily income. For many respondents who earn below minimum wage, FMCGs allow them freedom to choose premium products, albeit in small quantities, enough for a day’s use. The following day, they will again buy sachets of goods they need for the day, and the cycle continues. Hence, the availability of FMCGs packaged in sachets in sari-sari stores make them more accessible to people with limited income.

Tingi: Preference for sachets

Respondents were asked what “tingi” means to them. This open-ended question generated similar responses. Foremost, “tingi” is the act of buying small amounts of goods and is a practice done by everyone. As one respondent said,

Ang tingi ay Pinoy na Pinoy yan! Dahil tayo naman ay di mayaman, iilan ang nakakarangya sa buhay, kaya parte na ito ng pagiging Pinoy. Me tindahan pa na malapit, na maraming tindang sachet. kaya patok to sa pamilyang Pinoy. (Doing tingi is something very Filipino. Many of us are not rich, and there are fewer people who are doing better economically than others, and with a store nearby selling sachets... this is patronized by the Filipino family.)

The survey also confirmed that sachets are staple in Filipino households. When prodded on which household commodities are most often bought in sachets, the top three were: 3-in-1 coffee (86%), shampoo (80.3%) and toothpaste (75%) (Table 18).

Table 18. Commonly bought products in sachet

Products bought in sachet	Frequency	Percentage
3-in-1 coffee	258	86.0
Shampoo	241	80.3
Toothpaste	225	75.0
Bath soap	222	74.0
Milk	213	71.0
Laundry soap	207	69.0
Conditioner	201	67.0
Fish sauce	195	65.0
Vinegar	189	63.0
Soy sauce	185	61.7
Cooking oil	180	60.0
Catsup	162	54.0
Medicine	127	42.3

**Multiple responses*

A visit to any sari-sari store in the City of Dasmariñas (Figure 22) would show how commonplace and essential sachets are in Filipino life. As mentioned, in the early morning, *pandesal* and coffee (from a sachet) are a breakfast meal for most families, even when cooked rice and viand (dishes accompanying rice) may be available.

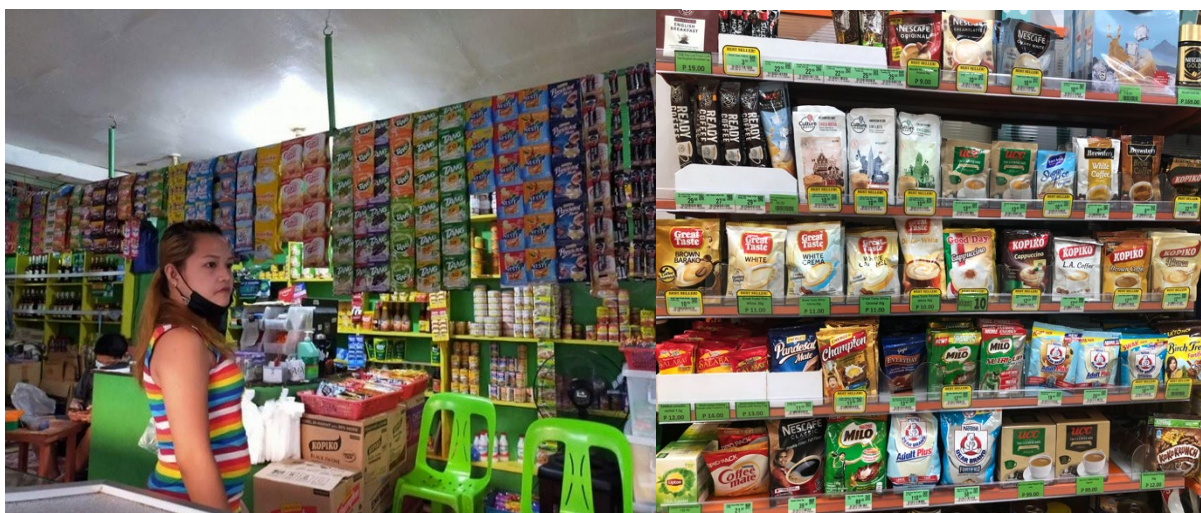


Figure 22. Typical display in sari-sari store (L) and 24-hour convenience store (R)

Moreover, for those who need to wake up early to commute to their workplace, a visit to a convenience store is indispensable: this is where sachet goods for meals or snacks (coffee, powdered milk, cereal etc.) can be bought.

While it is undoubtedly one's economic status that results in buying "tingi", it is interesting to note that even those with above poverty income also favor "tingi" over bulk buying. One office worker, Lyn, 42 explains that,

Ako, fan ako ng 3-in-1 [coffee, sugar, cream]na mga kape. Kasi, maraming flavors, gusto ko matikman lahat. Kaya hindi sya, magastos, pasok sa budget kasi me sachet available. [Me, I am a fan of 3-in-one coffee. It's because there are many flavors, and I want to try them all. That is why it is not pricey, it's within budget because there's sachet available]

Similarly, Fe, 38, a teacher expressed the convenience of buying powdered juice in sachet,

Nasa instruction ng sachet na ibuhos lang sa pitcher. Di mo na sukatin. Stir and enjoy lang. Pagbukas, buhos, tapon. Mabilis sya compared sa sukatin mo pa ilang kutsara, tikman pa. di ba bawas work? [There's instruction in the sachet to pour in a pitcher. No need to measure. You just must stir and then, enjoy. After opening (the sachet), pour, throw. This is more convenient compared to measuring how many spoons, then taste test.]

The narration above corresponds to the survey results that convenience and budget concerns are important motivations for using sachets. "Tingi" is a good fit with the

Filipino's day-by-day mentality of making spontaneous decisions as to what product one wants (or is able) to use for the day, be it shampoo, juice, and coffee among others, plus the expediency of opening a sachet and throwing its packaging right after. The next day maybe, that same product might not be to one's preference, and hence, one can just try out another brand at a minimal cost, a possibility afforded by sachets. Whether it is coffee, shampoo, conditioner, soap, and detergent, buying products in "tingi" even becomes more convenient because nearby "sari-sari" stores sell them, as evidenced by the study's result. The problem of waste is clear in this respect because sachets offer a lot of ease, but the package cannot be re-used or recycled and should be disposed of after use.

The notion that sachet packaging is integral to "throwaway" culture is clear in this respect. Loosely described as the consumerist behavior of buying products for single use, "throwaway culture" emphasizes that packaging is considered as waste, and thereby thrown after use and hence, sachets are the most appropriate illustration of this practice.

Filipino ingenuity

Filipinos are proud to call themselves ingenious for making the best out of their resources and means. This character is more evident when waste pickers, garbage collectors, or what Filipinos refer to as "mangangalakal" earn substantially not just for their family's basic needs but also for the education of their children.

Roberto, 62, a differently abled husband (as his left foot is shorter than the right) earns a living by waste picking in their village. His wife is a domestic helper in a nearby residence. Seeing his condition, many of his neighbors voluntarily give him recyclables and other trash that can be sold to junk shops. Roberto narrates that he collects for two days using his bike (with sidecar) before bringing them to a junk shop of which he is a "suki" [frequent seller or customer], earning him about P700 each time. He says,

"isa lang naman lagi pinupuntahan ko lagi, ito lang kay Mang Jack, kasi maayos magbayad. Sa isang linggo, pag nakatatlong hatid ako, meron akong mga P2,000 na kita. Ayos na yun." (There is only junk shop that I go to, it's Mang Jack's because he pays well. In a week if I can bring [recyclables] 3 times, I can earn about P2,000. It's good already.)



Figure 23. Junkshop workers assist waste pickers

More income is generated when one becomes a junk shop owner (Figures 23-24). Mang Jack, 55 and his wife Aling Tess, 50, started their junk shop business 10 years ago, but clarified that within the first five years, it was not continuously thriving, and thus, they had to close shop several times every year, but opens once again when there was money for capital. Within the last five years, the business got its footing and within two years, the couple surmised that it is already established. The couple found a strategy to keep their business flourishing. On a day-to-day basis, they give at least PHP2000 each to five waste pickers to buy recyclables worth the amount given. If the waste pickers can bring more, they only need to return the capital given to them and keep the remaining for themselves. To incentivize, they give a certain amount to the highest picker for the day. Mang Jack says this strategy works in many ways. First, it assures that daily, the shop will have recyclables. Second, it builds loyalty among his workers, which is very important because there are many junk shops competing for recyclables. Third, because they pay fairly, for many of their workers, the junk shop serves as their lifeline, their source of livelihood that they can rely upon for their needs. Aling Tess, proudly said she has seen how their community has changed:

“Noong wala pa tong junkshop, hirap mga tao dito. Ngayon, kahit papaano, merong mga pamilya na ito talaga ang kabuhayan nila, magkalakal, kasi halos lahat naman pwede ma recycle, kaya kung matiyaga lang, kikita sila”. (Before this junk shop was put up, folks here are hard-up. Now, there are families which make this [bringing

recyclables] as their livelihood, because almost all can be recycled, that is why, if they are just hardworking, they will earn)



Figure 24. Junkshop frequented by waste pickers (L) who bring anything recyclable (C). A semblance of formality is established as transactions are done in a junkshop office (R)



Figure 25. Dunk your bottle in Real Elementary School

Even during the COVID 19 pandemic, the junk shop still operates and has not experienced major financial setback. Recyclables can still be sourced, except paper, because many schools are closed.

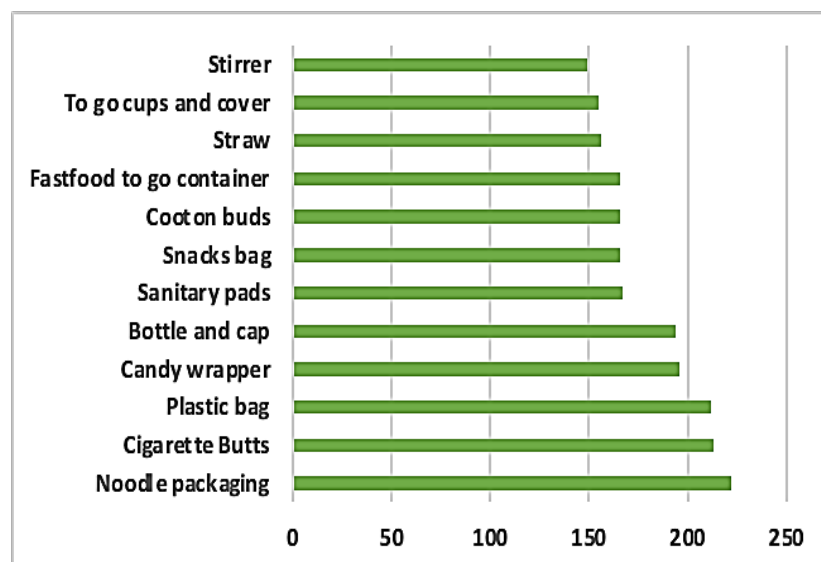
From the above, it can be deduced that junk shops are considered source of livelihood for many families and is a sustainable means even during difficult times.

Another demonstration of this ingenuity is shown by a school principal, Ms. Rhodora Sacramento, whose personal advocacy for the environment is reflected in how she handles the garbage problem of the school. With more than 3,000 students and workers staying in the school premises pre-pandemic, she was beset with the problem of trash disposal upon assumption of office in 2019. She recalls that the volume of garbage was just too much and need to be solved sustainably. Ms. Sacramento thought of strategies that are effective and fun. First is dunking one's bottle (Figure 25). Students and teachers alike can shoot their beverage bottles in a ring with a depository net at the bottom. This guarantees collection of single-use plastic bottles. Ms. Sacramento also incorporated all activities on waste management in the Science Club organization of the students, and so, with the Science teachers as advisers, she is assured that when she is re-assigned to another school, the projects will continue.

What Gets Thrown in the Imus River and Who's Responsible?

Common Plastics Thrown

When respondents were asked about their observation on the usual plastics thrown in the river, the top three responses were: noodle packaging, cigarette butts, and plastic bags (Figure 26).



**Multiple responses*

Figure 26. Frequently thrown plastics in the river

Thrown plastic items are typical of Philippine households, which consume instant noodles regularly as evidenced by the Philippine Statistics Authority's (PSA) 2015-2016 Survey of Food Demand for Agricultural Commodities (SFD). The report indicated that Instant noodles were the commonly eaten noodle product in CALABARZON with estimated yearly per capita consumption of 2.66 kg. Consequently, this translates to a large volume of plastic waste.

Other plastics thrown to the river observed by the respondents were similarly related to food and other household goods like candy wrappers, bottles, and sanitary pads.

Waste pickers and junk shop owners interviewed attest to the results above. Mang Apolonio, 52, a wastepicker asserts that,

"Mga basura na di na mapakinabangan, marami tinatapon na lang sa ilog kasi ano pa gagawin dyan? Minsan mga tao na rin ngtatapon dyan kasi di na makahintay sa araw na me kukuha ng basura. Apaw na."
[Trash that cannot be recycled are thrown here because these are useless. Sometime people throw their trash [in the river] because they cannot wait for the scheduled collection day. Their trash is already overflowing]

In Tubuan 1, Silang, however, the trash thrown in the Tubuan creek, a tributary of the Imus River is not the ordinary food packaging but includes broken appliances, defective furniture, and tires (Figure 27).



Figure 27. Garbage disposed in Tubuan, a tributary of the Imus River

The creek has a bridge that serves as the only passage to touristed Tagaytay and is cleaned weekly by the barangay officials themselves. As barangay Captain Ambita said,

“Isang linggo lang na di kami makapagclean-up, napakarami na ng basura sa ibaba. Magtataka ka, walang mga bahay dito, pero ang daming mga basura. At di lang basta-basta, pati mga sirang appliances, mga goma bukod pa sa mga pambalot ng groceries.” [In just one week of not cleaning up, so much trash is accumulated below [referring to river]. And these are not your ordinary trash, they include defective appliances, tires, and packaging of groceries]

This compels the officials to clean the river and its vicinity weekly (Figure 28). Very few residents volunteer, but it is seen as part of the job of officials.



Figure 28. Clean-up days on Saturdays in Tubuan Bridge (L) with barangay officials removing trash thrown by passersby (C, R)

Personal involvement in the use and disposal of plastics

Scaled-response questions were asked to determine the respondents' views regarding their use of plastic, their feelings of accountability, and value given to initiatives curbing plastic pollution. Using the following as reference: 4.2-5.0 (*very high degree*); 3.4-4.1 (*high degree*); 2.6-3.3 (*moderate degree*); 1.8-2.5 (*low degree*); 1.0-1.7 (*very low degree*), several noteworthy observations can be gleaned.

Preference for “tingi’ and its effects

Those who buy by bulk or big quantities (big cartoons, containers, and boxes) are those who do their grocery shopping once a week and in supermarket or in grocery stores inside malls. By implication, they do not belong to the lower socio-economic strata because this entails a bigger allocation of budget.

Table 19. Preference for shopping by bulk or tingi

Statements	Mean	Interpretation
1. I prefer buying products in sachet than in big bulk.	3.51	High
2. I know my neighbors prefer sachet and tingi compared to big bulk.	3.93	High
3. I would be willing to buy products with no packaging, and with refill, such as shampoo.	3.50	High
4. We could not afford buying big bulk.	3.75	High
5. We do not choose to buy in big quantities.	3.64	High

The respondents admit that it is their choice to buy “tingi” and not in bulk because of budgetary constraints. They also think this practice is resonated by their neighbors. However, there is willingness to buy products that are refillable (Table 19).

Accountability

What do the respondents think about the effects of indiscriminate disposal of plastic? Do they think they part of the problem? Whose problem is plastic waste pollution?

Table 20. Accountability for plastic pollution

Statements	Mean	Interpretation
1. Just like the residents in this community, I am part of the reason why there are plastic waste problems.	3.65	High
2. Plastics thrown in the river eventually destroy the seas/oceans.	4.24	Very high
3. Plastics affect our health, for example, through the fish we eat.	4.24	Very high
4. There is no choice but to use plastic because it is part of the goods buy.	3.86	High
5. It is the governments' task to manage waste, not of the ordinary citizen.	3.22	Moderate
6. Residual waste should be the concern of the government, not the people's	3.13	Moderate
7. If there is a clean-up, I am willing to help.	4.04	High
8. The trash from big stores caused more pollution of the river more than household trash.	3.44	High
9. The community consider plastic waste management a simple problem.	3.22	Moderate
10. My family is not concerned with plastic waste management.	2.93	Moderate

The respondents strongly agree that plastics thrown to the river will destroy the ocean in time and also affect human health through ingestion, specifically of the fish we eat. Noted too is strong agreement in the statements 1: *Just like the residents in this community, I am part of the reason why there are plastic waste problems*, 2: *There is no choice but to use plastic because it is part of the goods buy* and 7: *If there is a clean-up, I am willing to help*. Though there is admission that they play a part in the plastic pollution problem, and hence, their willingness to be of assistance to clean-up efforts, there is likewise a strong belief that there is no choice but to use plastic as these are used as packaging, and that big stores contribute more to the plastic waste problem (Table 20).

Observed initiatives on proper plastic waste management

Common efforts to curtail plastic use and its wanton disposal were also investigated in the survey. Actions on waste management recognized most essential by the respondents are: waste collection, addressing the province's garbage problem, clean-ups, and recycling efforts (Table 21).

Table 21. Important initiatives to curb plastic waste

Statements	Mean	Interpretation
<i>(Which of the following do you consider very important?)</i>		
1. Refusing usage of plastic products	3.65	High
2. Repurposing/redesigning plastic products	3.92	High
3. Re-using plastic products	3.77	High
4. Reducing use of plastic	4.12	High
5. Clean up and clearing	4.34	Very high
6. Volunteering for clean up	4.17	High
7. Recycling plastic	4.22	Very high
8. Factories not allowed/limited in the use plastic for packaging.	3.91	High
9. Relocating informal settlers living near river	3.77	High
10. Solving Cavite's plastic waste problem	4.38	Very high
11. Regular and proper waste collection	4.43	Very high

Other initiatives were also considered highly important such as volunteering for clean ups and limiting plastic use. The lowest score was on refusal on the use of good made from plastic.

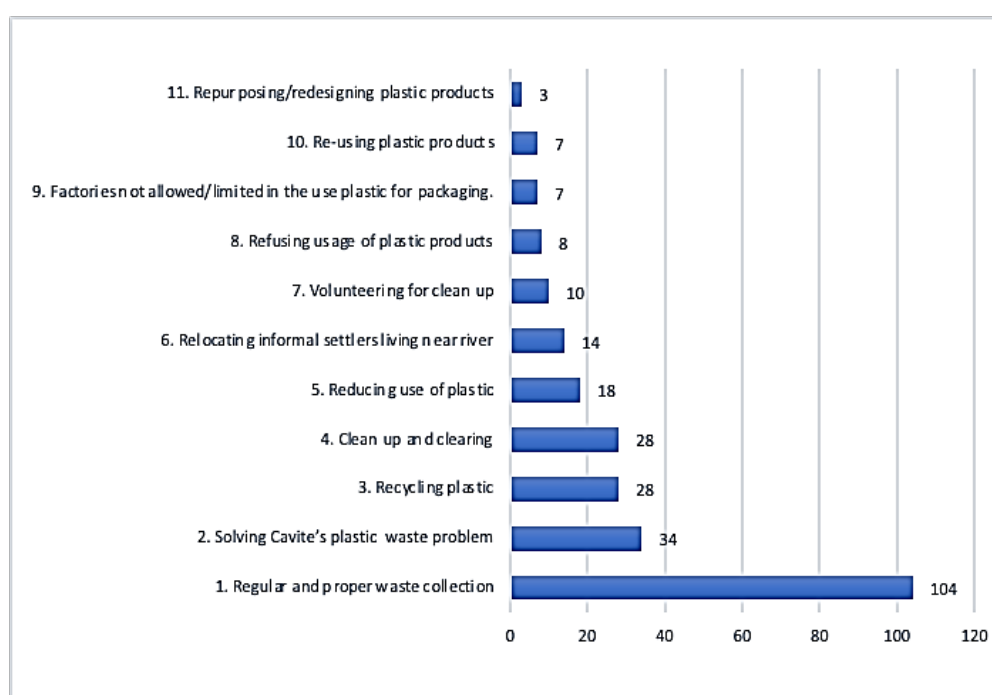


Figure 29. Most important initiatives

The same items were used to determine the initiatives deemed most relevant for the respondents. The top three efforts considered most important were: *first*, regular and proper waste collection, *second*, addressing Cavite's problem of plastic waste,

and *third*, recycling and clean up (Figure 29). All these initiatives focus on eliminating the physical presence of garbage, but do not address the root causes.

Secondary Effects of Plastic Waste Management

Table 22. Perceived secondary effects

Secondary effects	Mean	Interpretation
1. Cleaning operations near the river disrupt the lives of informal settlers.	2.87	Moderate
2. Using paper as packaging can result in more expensive products.	3.18	Moderate
3. Using plastic bags as wrapping/package in the market is better compared to paper.	3.43	High
4. The operation of junkshops will be limited if plastic laws are strictly enforced	3.53	High
5. A possible ban on the use of plastic could result in more environmental problems such as the use of paper for wrapping/package.	3.33	Moderate
6. Plastic waste initiatives are further undermining people's trust in the government	2.99	Moderate
7. Certain initiatives, especially local laws on plastic use, favor only certain sectors of society.	3.05	Moderate
8. Plastic waste initiatives are just propaganda by politicians or organizations.	2.98	Moderate
9. The real beneficiaries of plastic waste initiatives are not the residents.	3.00	Moderate
10. Prohibition on retail items will result in my inability or difficulty to purchase.	3.47	High

It is inevitable that successful mitigating efforts to manage plastic waste may likewise result to consequences deemed undesirable in their impacts on people's lives. The top three most perceived impacts were: *first*, curbed junk shop operations, *second*, difficulty in packaging goods from wet market, and *third*, expected budget restraints should "tingi" be banned (Table 22).

Limited junkshop operation: limited income for waste pickers

House Bill No. 9147 or the proposed Single-Use Plastic Products Regulation Act was finally approved on July 28, 2021, in the Lower House. The bill seeks to mandate

within a year of enactment into law the halting of production, importation, sale, distribution, provision, and use of single-use plastics. These include drinking straws, stirrers, plastic sticks, confetti, and packaging. Prior to this mandate, a city ordinance on the ban has been in place. Would this adversely affect the income of waste pickers and junkshops whose livelihood depend on recyclables, which includes plastic?

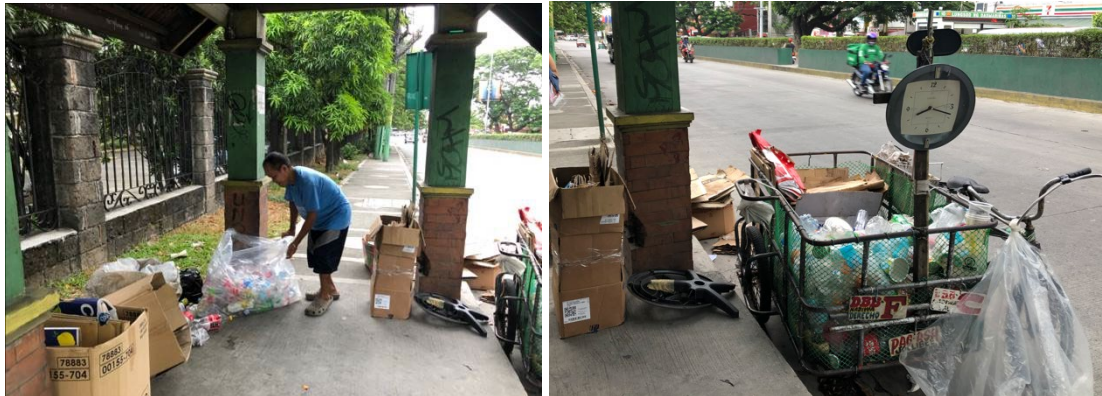


Figure 30. Mang Apolonio sorting recyclables he collected (L) in his bike with sidecar (R)

Apolonio, 52 is a waste picker, and has been doing this job for 15 years (Figure 30). His wife, Rosa, 57 is a ragmaker for more than five years. He has a motorcycle with “side car” to carry his daily haul. He picks recyclables from the center of the town “bayan” before the scheduled pick up of government garbage trucks:

Marami akong nakukuha kasi inuunahan ko ang mga truck bago dumating, kaya madalas, 10 PM, lumilibot na ako, kasi ang mga tao, nglalabas na ng basura nila bago sila matulog. Matatapos ako ng mga alas 7 at dito ko pinaghihiwalay (waiting shed) bago ko dalhin sa junkshop. (I get so many [recyclables] because I start collecting before the garbage truck arrives, that is why at 10 PM, I start going around, because residents bring out their trash before they sleep. I finish at 7:00PM and I start sorting in this public shed before I bring them to the junkshop)

Before the pandemic started, he earned an average of PHP1500 to 1700/day, and now he gets about half of it. He explains that the closure of many stores and schools at “bayan” (town center), in addition to the people’s inability to shop “normally”,

result to less containers, bottles, carton etc., in their trash bins outside of their houses.

He further explains that when recyclables are not segregated, junkshops buy them at 10 pesos/kg, but if segregated, prices per kg depend on the kind: “sibak” (hard plastic) is PHP20, PET is PHP8, carton is PHP9, white paper is PHP7, unsegregated paper is PHP2, tanso/copper is PHP350. He also gets appliances sometimes and these are disassembled and sold per part, i.e., plastic part is PHP10/kg, aluminum is 8 kg, etc.

Apolonio narrates that he has given a comfortable life for his four children through waste picking. All his children are still single and living with him, except for Emma, 28 who recently went abroad. She finished a caregiving course six months ago and is now in Kuwait to work as an elderly caregiver. Her contract stipulates that her placement fee will be deducted from her monthly salary, and so far, she is doing good as she has been sending money. Apolonio said he spent only about PHP15,000 for all the requirements Emma needed, on top of her caregiving course which he paid for, all from his waste picking. When asked if he will soon stop, as Emma is sending money:

“Hindi siguro. Pera nya yun, mag aasawa din yun. Meron pa akong tatlong anak, at sayang kita dito. Maayos naman, araw-araw meron naman.” [I think not. It’s her money, and she will get married someday. I still have three children, and I earn here. It’s okay, I earn every day]

His three other children (Lea is 19, Ria is 13, Beth is 11) are still in school, and he is saving for college. His wife helps as she sews rags from scrap cloth they buy. With two sewing machines, she can produce 45 bundles (15 pieces/ bundle at P15), and they bring it to a “suki”, a middleman who sells them by bulk to his contacts. Apolonio narrated that his wife can produce this much because he helps after he sells his haul to his “suki” junkshop.

When asked what happens when people start segregating and sell their trash themselves, Apolonio said that some people in Bayan, most specifically those with big houses bring their trash already segregated but give them to him. He further adds:

“Una, di mangyayari yung segregation na yan, kasi me batas na nyan dito sa atin, matagal na, di naman ginagawa ng mga tao. Kung sakaling mangyari ang imposible, na hiwa-hiwalay na mga basura, tingin ko, tatamarin mga tao na dalhin mga to sa junkshop. Kaya ganun pa rin mangyayari- me mapupulot pa rin ako.” [First, segregation won’t ever happen because there’s already a law that’s already passed yet people

can't comply. But if the impossible happens that there is segregation, I think people won't do the additional effort of bringing them to junk shop. That is why if that happens, I think I can still find things to pick]

As a waste picker, Apolonio thinks he is doing the environment a big favor:

"itong mga kinuha ko, lulutang-lutang to sa tubig kung di sila ma recycle, sira kalikasan. Nakakatulong din kami mga namamasura."
(These things I picked, these would have been floating in the water if these are not recycled, and the environment gets destroyed)

When asked what he thinks of this job, Apolonio says he is contented with it, and he is happy doing this task especially in the company of other waste pickers- despite all of them competing for recyclables, he proudly says there is no envy or fights and there is respect for "territories" – meaning there are areas he does not go or enter because there are already wastepickers who had taken a claim—and they likewise do not go to his "territories".

On the community level, the implementation of segregation of trash appears to be arbitrary, dis-incentivizing those who diligently do. In most subdivisions in the City of Dasmariñas for example, waste collection is done once weekly by the City Environmental Sanitation Unit. According to its head, Mr. Nieto, their 26 garbage trucks ply through the 75 barangays of the city by schedule. When trucks cannot collect due to mechanical problems, the volume of complaints sent through his messenger account is unceasing until the barangay's trash is collected. Residents likewise take pictures of the mountains of uncollected trash and post them in the Facebook page of the city government, earning him the ire of the mayor.

For Mr. Nieto, the core problem is the lack of segregation on the part of the residents:

Dumadami ng dumadami ang basura dahil hindi segregated. Kung mababawas sana ang recyclables bago pa ma collect, residuals na lang matira, pero hindi ganyan. In fact, residents complain that our garbae collectors, ang tagal magcollect sa bawat street dahil inuuna ang sorting, kaysa mangulekta" [The volume of trash keeps on increasing because there's no segregation. If the recyclables are removed before collection, and only the residuals are left, but it is not like that. In fact, residents complain that the garbage collectors take a long time in the streets because they would rather sort than collect]

For many subdivision residents, the problem is the lack of proper implementation of waste segregation. In the post survey FGD with the enumerators of the City of Dasmariñas, they concur that despite the city's ordinance, the implementation is not

strong enough, and no one has been fined for any violation. This, however, does not mean no one segregates. Mang Kanor, 47, a wastepicker from barangay Area C in Dasmariñas observes that a few residents sort their trash before placing them outside for pick up. He says,

Yung ibang mayayamang bahay, yung basurang nilalabas nila, maayos na, naka sort na, kaso, uunahan ka rin ng mga kapitbahay, halimbawa, yung mga gwardya, sila mismo nangunguha. [Among those who have big houses, the trash they dispose are segregated before these are brought outside to pick up. But the neighbors pick trash first. In some instances, the guards themselves pick them up]

Still, for many residents in subdivisions, without penalty for non-segregation as all garbage are collected, the practice of indiscriminate disposal of trash continues. When garbage trucks arrive, some garbage collectors go down from the truck to pick the bins, then throw them to other collectors who are left on the truck and are ready to catch them. They then empty the contents and throw back the bins to the collectors on the ground. The collectors on the truck segregate right away, and so, by the time the scheduled collection is finished for the day, the trucks proceed to the junk shops the garbage collectors have long-standing agreement, albeit informal. Overall, eight to 10 waste pickers per truck are given the “privilege” to be allowed to assist four regular helpers to collect trash.

“Pag pinasampa ang isang basurero sa truck, walang bayad yun, yung mga driver at helpers ang pumipili sa kanila para makasampa. Yung mga matitino rin lang, na maasahan mo mabilis magtrabaho at di umaabsent. Maayos din ang kita nila dyan. Araw-araw me kita pagkatapos ng schedule nila.” [When one wastepicker gets on the truck, he is not paid; it is the driver and the helpers who choose who can join them. Only those who are responsible and can be relied upon to work fast and not skip work are invited. They earn good. Every day, they can earn after they are done with work]

Mr. Nieto divulged that the city government of Dasmariñas will strictly implement the “no segregation, no collection policy” before the year ends. The city mayor has given instruction to be firm in carrying out the policy because the present system is very expensive to maintain. Also, the newly opened landfill will be easily filled up, and finding a new site for a landfill requires lengthy dialogue which usually becomes divisive: the residents of the proposed site vs the officials who proposed it.

These sentiments are resonated by Herry Caballero, the MRF administrator in Silang. He said that segregating should be properly done at the household level. He explained that the Silang MRF can handle all kinds of wastes, even plastics, but the

MRF is bogged down by machine repair due to unwanted materials that are mixed with recyclables. He explains that if household wastes are segregated properly, the collection will be faster, and plastics can immediately be fed into their shredding machines. The main problems are the lack of segregation and the improper segregation in most barangays in Silang. In many instances, hard materials get mixed with plastics and foil, which damages the machines or make the blades dull.

Switching to paper packaging and costs

It is a common practice for many parents to make sure that their school children bring snacks from home instead of buying from the canteen or vendors outside to control their junk food intake. Individually wrapped cupcakes, biscuits, and wafer, among others, are usual preferences due to their affordability, convenience, and good taste. Some examples are the “fudge bar” and “quake bar” (Figure 31) which are sold by 10s at P150-170 which are manufactured by Robina Corporation, a Filipino owned company.



Figure 31. Common snacks brought to school (L) and their foil wrapper (R)

Even in “sari-sari” stores, the popularity of these cupcakes and bars cannot be overemphasized. Parents consider these healthy alternatives, and children find them great-tasting and fulfilling.

When asked about the packaging, Mr. and Mrs. Perez, parents of elementary pupils, attest that due to the foil wrapper, the chocolate and other syrupy topping does not turn gooey, and the cake’s shape and form remain the same even when it is placed in their child’s schoolbag. Even small children need not be supervised during snack time because the cupcakes or bars are not messy due to their packaging.

This is yet another example of how common people regard the convenience brought by plastic packaging: premium products become accessible for all segments of the population through sachet packaging.

Following the above, for the enumerators of Pulvorista, Kawit, the problem of waste (Figure 32) cannot be simply attributed to people's lack of discipline in sorting trash but rather to the packaging that comes with the products they buy. In the post-survey discussion, they expressed the sentiments of the residents:

"Sabi ng mga tao, wala naman din choice, kasi yun ang pambalot. Kaya, kahit sana tapon ng tapon, kung di naman plastic, di naman siguro masama sa ilog." (The residents said, there is no choice because it is the packaging. Even if people just throw anywhere, if it is not plastic, it is not bad for the river.)



Figure 32. The Imus River by the highway in Kawit is deluged with plastic packaging

The ESU Head of the City of Dasmariñas, Mr. Nieto explained that it is realistic to consider selective banning of plastic, and pilot testing in wet markets can be facilitated in the initial stage. For example, fish and meat need not be placed inside plastic “labo” if people bring their own containers like pail for these products. Instead, the practice in wet markets at present is doubling the plastic carrier bags as demanded by consumers to make sure that no liquid substance comes out or that

smell is contained. Furthermore, Mr. Nieto admitted that the lack of regulation of plastic use in wet markets has resulted to overuse of plastic such that all items are packaged in plastic bags even those that need not be placed such as leafy vegetables and other dry goods.

Imminent Budgeting Trouble with Tingi Ban

From the survey, there are four linked reasons for buying “tingi”. First, money is scarce, so there is no choice but to buy “tingi”. Second, there is money, but just barely enough to be able to sustain their needs on a day-to-day basis. Third, “tingi” is cheap, so it fits the respondents’ income (Figure 33). Fourth, *tingi* is about controlled use of goods, which is important for people with meager income.



Figure 33. Tingi of commercially prepared cooking oil, 300ml at P24 (L) and sari-sari store-prepared at P8 (C), as compared to one liter at P102 (R)

For many Filipinos, it is unimaginable to survive without these retail products. Practically, all commodities needed for daily life, from hygiene essentials to cooking condiments, are sold in sachets, making them accessible to the common Filipino. Some sachets are commercially packaged while others are prepared manually by enterprising vendors.

It would seem then that “tingi” is here to stay.

Summary

The role of culture in the wanton use of plastic is contextualized through the pervasiveness of the practice of “tingi”, the partiality of Filipinos to buying products in tiny individual packages, corresponding to what is generally known as the *sachet culture*. “Tingi” is pervasive in the Philippine retail industry through the sari-sari stores, the Filipino version of sundry stores which are ubiquitous in neighborhoods. The proliferation of “sari-sari” stores can be attributed to the ease of obtaining a business registration compared to other small and medium enterprises, and the zero taxation if the annual income is PHP 250,000 or less. By practice, “sari-sari” stores do not issue receipts, so monitoring their income is not done, and keeping it small enough enables owners to operate their stores with no hassle. Selling mostly fast-moving goods in sachets such as noodles and coffee, “sari-sari” stores are patronized by minimum-wage earners. Those earning more also buy sachets in sari-sari stores for their convenience: there is no need to measure how much is needed, one sachet is one use, whether it is shampoo, coffee, or milk. Thus, it is easy to see how the “sari-sari” store fits into the way of life of the common Filipino. This is also the primary reason why respondents in this study point to the “sari-sari” store as the most common source of plastic waste via sachet packaging.

Recycling plastics have become a source of livelihood for enterprising Filipinos through junk shop or waste picking businesses. Junk shops accept all recyclables, including plastic bottles and containers but not sachets, which are considered residuals often ending in landfills or just thrown anywhere including in the Imus River.

Though there is admission that they play a part in the plastic pollution problem, hence, their willingness to be of assistance to clean-up efforts, there is likewise a strong belief that there is no choice but to use plastic as these are used as packaging and that big stores contribute more to the plastic waste problem. Respondents recognize that there are initiatives to manage plastic pollution, of which the most essential are waste collection, clean-ups, and recycling efforts.

All these initiatives seem to focus only on disposal as garbage is an eyesore but does not include the root causes such as targeting the sources like limiting production of plastic. The respondents, however, believe that efforts to curb plastic waste, from regulating production to segregation, will have negative secondary effects: *first*, junk shop operations will be affected, *second*, packaging goods from wet market will be problematic, and *third*, budget restraints should “tingi” be banned is imminent.

The cultural context must be considered, as it shows the complexity of the plastic waste problem.



Conclusions and Recommendations

Conclusions here are presented according to how the research questions were framed. This is followed by a discussion geared towards a policy framework in understanding the social implications of plastic waste pollution initiatives in the province. In the end, practical recommendations are advanced in relation to the salient findings.

Conclusions

This study provides a direction in the understanding of the social consequences of plastic pollution mitigation initiatives along the Imus River. It identified current initiatives on plastic waste management from the vantage point of the people in the selected communities. Consequently, it sought to examine the management and implementation of those initiatives and evaluated the cost and benefit of the same to determine their operational and economical profitability. The study likewise describes the cultural underpinnings and potential secondary effects of plastic waste management measures in the province.

While there are many initiatives addressing plastic waste pollution in the province, it is apparent that community residents are only aware of clean-up drives as the prevailing initiative to address plastic pollution and leakage into the Imus River. This implies that the communities do not have sufficient knowledge and information as to the magnitude of the problem and/or possible solutions to plastic waste in the area. The data suggest, however, that they are cognizant of their role in the worsening problem of plastic pollution and are willing to participate in mitigating measures to address it.

This study considers certain initiatives beyond community perception, using the Wangwa Waste Management Model, to identify best practices in curbing plastic waste, namely War on Waste, BasuRaffle, and Waste to Ecobricks technology. Consequently, cost-benefit analysis for each best practice was explored using Private Benefit (B_P) as well as Total Benefit (B_T) derived from their operations. The final analyses point only to War on Waste as cost-effective and financially sustainable, which significantly helps in curbing plastic waste with the sphere of its operations. While BasuRaffle and Waste to Ecobricks technology help in controlling or giving a second life to plastics, they are not operationally profitable.

Local government officials presented varied initiatives, mostly on recycling and giving plastic a second life, as best practice initiatives. There are also laws that directly seek to address plastic waste in the province, e.g., selective plastic ban and use of eco bag. Local laws are in place in the province, cities, and municipalities to mitigate plastic waste and to regulate its use and disposal, but these policies may translate into few actions.

This study also explores the cultural aspect of plastic waste management in the province. Most of the plastics used in households are in forms of sachets for retailed fast-moving products (tingi) from sundry stores (sari-sari) ubiquitous in the neighborhood generally purchased for their premium quality at a seemingly affordable cost. While community people are aware of their contributions in plastic pollution, they are left without a choice as most of their daily needs are purchased with plastic packaging. As such, they single out regular and proper waste collection as the most important measure to address the possible plastic leakage in river systems.

Mitigating efforts in plastic waste management likely result to limited income for waste pickers who earn from recyclable plastics to difficulty in packaging goods from the wet market or in finding cheaper alternative packaging, and to budget restraints for most people in the community with meager income.

The overall picture of plastic waste mitigation is marred by structural restraints. Laws are abundant, even duplications are observed, to reverberate the call of a national law to limit usage and generation. There might be some violations, but to a level not enough to call attention. After all, the looming problem of plastic waste must be curbed at its root as there is more to plastic waste pollution than co-processing, recycling, and the like. On the hindsight, the current system benefits those from the opposite ends of the spectrum—the producers who make the most of economic benefits out of the plastic conundrum, and on the other end, the consumers who earn and able to thrive because of the same tingi culture.

Towards a Policy Framework

Given that plastic pollution is more than environmental, this study hopes that policymakers, project managers, and advocates against plastic pollution would take a cue into how communities understand the problem, i.e., it is social. Thus, to be able to respond appropriately towards the intended outcome of a social concern, its social implications cannot be understated.

Against this backdrop, a schematic diagram (Figure 34) is advanced to describe plastic pollution derived from understanding the context of communities as basis policy framework in addressing plastic pollution in the province. It illustrates the plastic pollution mitigation derived from understanding the context of the communities that contributed to the problem of plastic waste along the Imus River.

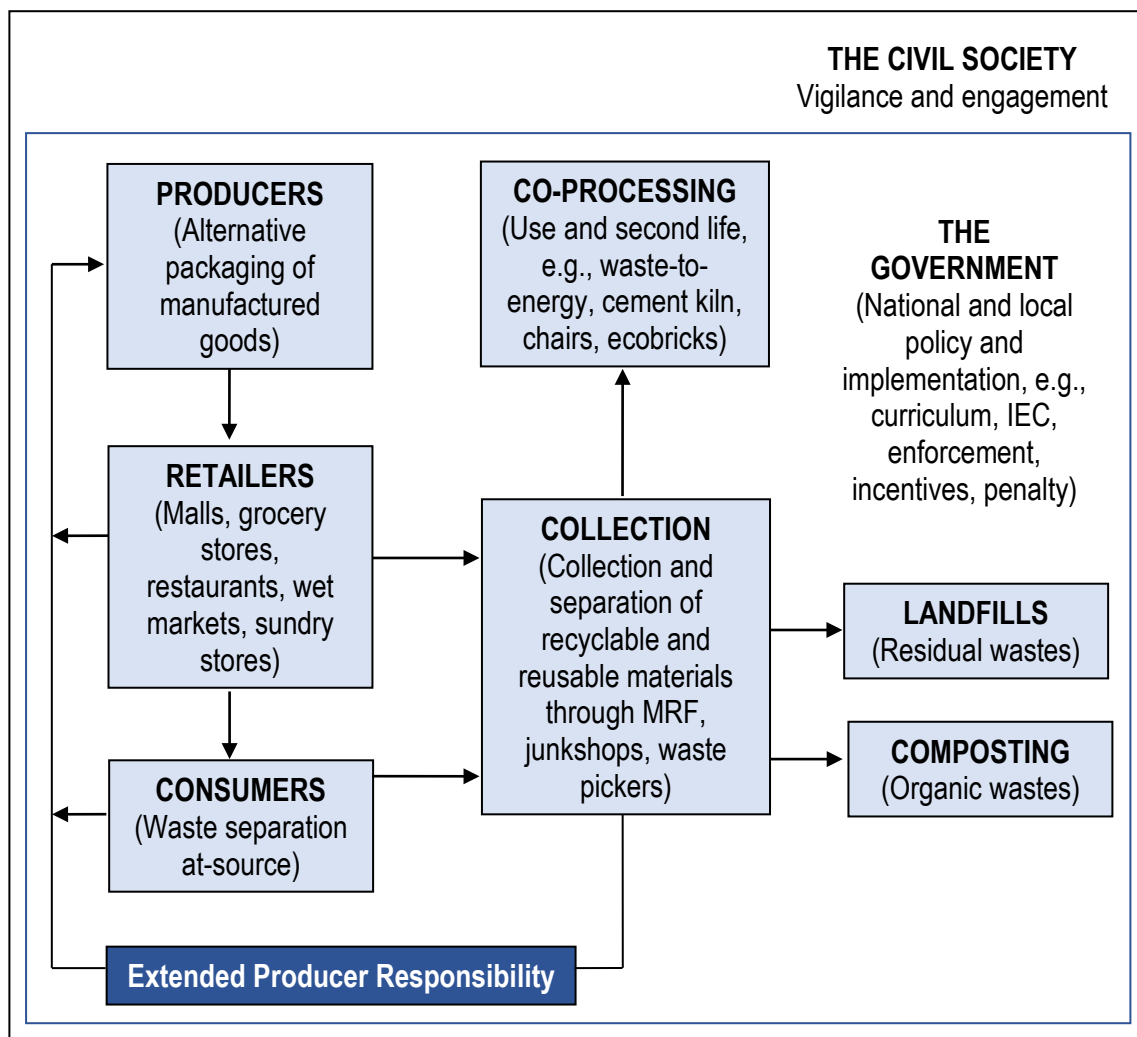


Figure 34. Contextualized plastic pollution mitigation

Many different agents may contribute to addressing and mitigating plastic pollution along the Imus River. By application, policy and implementation should be geared at engaging every agent (producers, retailers, consumers) at every stage in the plastic chain (collection, co-processing).

Producers need to find alternative packaging for manufactured goods that are distributed to retailers and eventually lead towards the consumers who has separate waste at-source. This is only possible with the enactment of clear laws on extended producer responsibility (EPR) that compel manufacturers to abide by them.

Waste needs to be collected and separated at-source, with existing waste pickers, junkshops, and community material recovery facilities able to salvage what can be recycled and reused. This limits what may be brought to landfills.

In all of those processes, the role of the government in national and local levels is paramount with the engagement and the vigilance of civil society.

In sum, understanding Cavite's experience in plastic pollution mitigation touches on several aspects such as manufacturing, use and generation, collection and co-processing, and consequent end of life and disposal.

Manufacturing

Who should be responsible for the life cycle of a product, especially its collection/take back recycling and final destination? How can that process produce the most benefits, and are there better processes than what is currently operating? If there are better processes, how attainable are they?

With a concrete EPR law, plastic product manufacturers, distributors and industries using plastic should also be held liable for the life of their products and packaging after the consumer is through with them. At present, several bills have been filed mandating EPR, including House Bill No. 6279 by Congressman Rufus Rodriguez (Cagayan de Oro, 2nd District), Senator Cynthia Villar and Congressman Ruffy Biazon (Muntinlupa).

Companies responsible for their products would simplify and streamline those products to be more recyclable and/or reusable, as well as less costly, thereby making the overall system less wasteful and more efficient. Industry control would relieve cities from community recycling expenses they could not afford.

Corporate objectives for maximizing profits are not always compatible with achieving the highest environmental values, minimum goals for materials recovery that increase gradually over time.

Use and Generation

In 2018, the National Geographic's study reported that 40% of plastic produced is packaging, used just once and then discarded. Granting that an EPR law is passed and implemented, the use of plastic for packaging will consequently be regulated. Packaging could then be made from biodegradable material as mandated by law and/or be collected by its manufacturer or producer.

However, this does not guarantee that all packaging will be retrieved; there will still be trash. In anticipation of this occurrence, a regulated collection scheme will ensure segregation or sorting. For example, scheduled collection of recyclable trash can be enforced as opposed to the indiscriminate collection done at present. For example, different types of trash can be collected in particular days. Curbside pick-up follows the same regulation. Likewise, residents must be constantly reminded that it is just as important to leave non-recyclables out of the recycling as it is important to put the good recyclables in the recycling.

Collection and co-processing

The collection of wastes can be done with ease when segregation or sorting of recyclables and non-recyclables have been done. Wastes that need to be disassembled for recycling, need treatment, or are considered hazardous should be collected and disposed appropriately.

Giving plastic a second life is a doable strategy in the Philippines, where implementation of an assumed comprehensive law is problematic. It is observed that many initiatives lauded as exemplary are directed towards the use of plastic as component of a usable furniture or construction material, particularly chairs, pavement, or wall.

The importance of increasing the number of possible measures that can be taken to turn plastic's linear, wasteful economy into a more sustainable, circular one is of utmost importance. Of equal relevance is the fact that while more attention should be given to ensure the reusability of packaging and products, it is important to acknowledge that within the present waste management system, recycling plays an

important role in supporting livelihoods, and creating additional income for households, barangays and/or municipalities and cities.

End of life and disposal of residuals

The United Nations Environment Program (UNEP) approximates that about 300 million tons of plastic is manufactured each year. Of that number, more than eight million tons find its way into waterways destroying the environment and killing fishes that ingest them. UNEP likewise states that rivers carry plastic waste from deep inland to the sea, making them major contributors to ocean pollution. Likewise, plastics litter streets, choke landfills and dumpsites, taking hundreds of years to disintegrate. If they are incinerated, they release toxins into the environment that contribute to health and environmental problems. However, in the Philippines, a national ban on incineration is enacted following the passage of two landmark laws nearly 20 years ago: the Philippine Clean Air Act of 1999 and the Ecological Solid Waste Management Act of 2000. This is why sanitary landfills are the final destination of residuals or materials that can no longer be recycled or repurposed.

When considering that most plastics, like bottles and packaging are designed for one-time use, the solution is clear: fewer plastics must be manufactured and produced only for things where no other material can be used except plastic. Hence, slowing the flow of plastic at its source, and improving the way plastic wastes are handled are imperative, yet have to be contextualized in what is feasible in the Philippines.

Within this context, the importance of educating people on how each one can make a difference becomes crucial.

Recommendations

Given the findings and understanding of plastic waste management in the province, the following recommendations are advanced.

Launch IEC campaigns. People in the studied communities are only aware of cleanup drives as the primary initiative that addresses plastic waste pollution in the river. In addition, regular collection was the only solution raised by the public regarding waste. As such, efforts must be made by the government and likeminded advocates to further publicize various actions being taken.

Increase public participation. People in the studied communities are aware of their contribution to plastic waste pollution, and seem willing to help address the problem. Thus, inclusive programs that seek to involve groups, households, and individuals in communities should be sought. This may only be feasible if the communities are deeply aware of the seriousness and threat of plastic waste pollution.

Enact an EPR law. While findings confirm the presence of general laws on ecological solid waste, selective plastic bans, and the promotion of more ecofriendly bags as alternatives to plastics, a policy on extended producer responsibility is called for. Specific laws targeting producers, in coordination with manufacturers, distributors, and retailers, increases accountability for proper waste disposal.

Consider alternative packaging. This study highlights the retail culture in these communities, which often uses single-use and difficult to recycle packaging. A movement towards more sustainable packaging, in addition to extended producer responsibility, would be necessary to reduce plastic containers or packaging materials without prejudice to local retail culture. The research and development of viable alternative packaging should be sought both by government and private industries.

Observe stringent implementation. The findings affirm that good laws abound in the country to address immediate community concerns. However, many are not implemented effectively, despite remaining good on paper. National and local chief executives need to play their part with more political will.

It is imperative that barangays, as grassroots implementors of policies affecting households, are consulted, and supported by their respective city or municipal governments in the implementation of waste management policies. For example, when *“no segregation, no collection”* is implemented at the barangay level, and residents resist, barangays should not be blamed by the city/municipal governments for non-collection. Instead, they must be allowed to proceed with their plan, with assistance granted for measures to induce compliance. Likewise, noteworthy measures stemming from barangays need to be heard. By way of example, as lamented by the barangay council in Salinas 1, Bacoor, accountability for one’s trash found in the river might be traced and addressed more responsibly when trash traps are installed, at least per city/municipality. These are articulations of the call for participatory leadership and governance that the study generated from the local leaders.



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The Research Team

The call to present a holistic view is addressed by the multidisciplinary composition of the research team.



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