Greening the Local Solid Waste Management Through Community Participation: Unfolding the Challenges and Creating Opportunities for Development Planning

Alex M. Alazada and Dina C. Magnaye

Abstract

The local government units (LGUs) are the principal implementers of the Ecological Solid Waste Management (SWM) Act 2000 (Republic Act 9003) in the Philippines. The law requires a *barangay* (village) to handle the segregation and collection of solid waste, specifically biodegradable, compostable, and reusable wastes. The municipality or city collects the non-recyclable materials and special wastes. The study aims to assess how community participation contributes to the greening of the local SWM utilizing the theory of participation and the approaches of community participation. The survey covered 100 households from a firstclass urban municipality. Key informants were interviewed, such as the local officials and SWM stakeholders. The study revealed that community participation contributes to the greening of the local SWM given the following conditions: (a) community members are familiar, aware of, and comply with the law and ordinances; (b) households are willing to pay for SWM services; (c) local initiatives are aligned with the sustainable development goals (SDG) 1, 3, 8, 7, 11, 12, 13, and 17; (d) local SWM programs adhere to Green SWM principles that are geared toward economic, social, and environmental sustainability; and (e) local SWM programs are efficient in responding to the SWM challenges and weaknesses and address them through the strengths and opportunities of the solid waste sector. These are necessary considerations in identifying the greening strategies for local SWM and mainstreaming them in local development planning.

Keywords

Awareness level · Community participation · Solid waste management and sustainability · Participatory community approach · Planned behavior

1 Introduction

Solid wastes are unnecessary materials from household, trade, and business activities (2022 SmartRanger, 2009). These can be classified based on their sources such as ordinary house waste, commercial, institutional, industrial, and construction; according to the contents such as organic material, glass, metal, and plastic paper, among others; and based on the possible hazard such as combustibility, radiation effect, toxicity, infectious consequence, among others (Leblanc, 2020).

Biodegradable wastes have been the most significant waste composition among solid wastes in developing and developed countries (Silva, 2018). These are very common in households, offices, and backyards. These are mixed with other types of waste in landfills. Silva (2018) also indicated that biodegradable wastes occupy almost 50% of the solid waste composition and are considered the most significant contributor to global warming and climate change by emitting this environmentally harmful methane.

The critical factors in the worsening solid waste worldwide include rapid urbanization and high population growth (McAllister, 2015). The Senate Economic Planning Office (SEPO) (2017) reported that the significant concerns of SWM in the Philippines include injudicious waste disposal, irregular and inefficient waste collection, and the insufficiency of disposal facilities like material recovery facilities

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A. L. Pisello et al. (eds.), *Building Resilient and Healthy Cities: A Guide to Environmental Sustainability and Well-being*, Advances in Science, Technology & Innovation, https://doi.org/10.1007/978-3-031-33863-2_2

(MRF) and landfills. Several issues concerning SWM are observed at the local level (cities, municipalities, and *barangays* or villages), including unrestrained disposal of garbage into the creeks by dwellers, non-practice of composting, littering, continuous use of plastic, and open burning of wastes. Added to these are the lack of community cooperation, participation in SWM practices, and compliance with rules and regulations (Atienza, 2008).

Greening of the local SWM becomes imperative in dealing with the SWM issues. Community participation becomes highly relevant across the hierarchy of SWM from disposal, recovery, recycling, and reuse. Elagroudy et al. (2016) emphasized that "greening in the solid waste sector will provide major benefits to societies and will significantly contribute to the indirect economic indicators in terms of employment generation, GHG emission reduction and its associated health benefits, enabling energy production, and protecting human health." This intervention is envisioned to contribute to sustaining the green economy.

The research was conducted to assess how community participation contributes to the greening of the local SWM. Specifically, the study aims to (a) examine how familiarity, awareness, and compliance of households with the SWM law and local ordinances entice community participation; (b) analyze the level of community participation in SWM implementation in terms of the willingness of the village residents to participate in SWM program; and (c) evaluate the efficiency of the implementation of the SWM law and initiatives based on the alignment of the SWM implementation with the SDG, Green SWM, and the pillars of sustainable development as well as the analysis of the strengths, weaknesses, opportunities, and challenges (SWOC) of the local SWM programs. All of these are envisioned to provide inputs to green local SWM planning.

2 Literature Review

2.1 Community Participation in Local SWM

The participatory dimension of SWM can be examined utilizing the theory and principles of community participation. Wates (2000) states that participation is "involvement in a group undertaking associated with a cause or purpose." Burns et al. (2004) indicated that community participation "concerns the engagement of individuals and communities in decisions that affect their lives…[…] improves democratic and service accountability, enhances social cohesion, adds economic value, provides opportunities to develop skills, and promotes sustainability."

According to Hamdi (1995), community participation is a "form of formal or non-formal partnership between families, community groups, government officials, and professionals to work on something." Community or citizen participation is linked by Arnstein (1969) with citizens' control of power. It is a power delegation where the formerly neglected sector exercising political and economic rights will now be mainstreamed. As Alexander (1975) stated, participation is "essentially good, for it brings the community together to be involved in crafting decisions for their good. Since the community participated in the activity promotes a sense of ownership and power among them."

Several factors influence community participation in local SWM. Knowledge is considered a factor in SWM cooperation and engagement (McAllister, 2015; Vassanadumrongdee & Kittipongvises, 2018). The study by Sudipta et al. (2016) revealed that knowledge of SWM correlates with preparedness to participate in the waste management program.

A study by Bagulong (2011) on community participation in Davao City highlighted that community participation could be measured based on five (5) indicators: SWM, materials and utilities, penalties, programs, and incentives. The implementation of the SWM program was above the minimum requirement, although not on the maximum execution level. Nevertheless, it showed that the villages properly managed the implementation of the Ecological SWM Act. Village enforcers contributed to a fair implementation or management of the law.

2.2 Greening the Local SWM

Local solid waste sector greening toward a green economy. Gaber et al. (2011) described a green economy with the presence of …[…] "public and private investments that result in improved economic returns, a healthier environment, and social development." According to them, greening any sector covers the "…process of configuring businesses and infrastructure to deliver better returns on natural, human, and economic capital investments, while at the same time reducing greenhouse gas emissions (GHG), extracting and using less natural resources, creating less waste, and reducing social disparities" (Gueye, 2010, as cited in Gaber et al., 2011). Godfrey (2014) indicated that the "waste sector, as with many sectors of the economy, is responding to the call to transition to a green economy."

The municipal solid waste (MSW) sector contributes to the local economy since it engages the workforce in labor-intensive SWM activities and requires investments in machinery and equipment for handling, transport, and processing (Gaber et al., 2011). Other economic activities in

the sector include recycling, composting, and energy production. In addition, "greening the solid waste sector" is recognized where "SWM will contribute to job creation, mitigate environmental and health impacts, and improve the whole nation's economy." (Gueye, 2010).

Greening the solid waste sector and the sustainable development goals (SDG). The greening of the solid waste sector is a means to contribute to the SDGs and green growth "through reduction of waste, conservation and efficient use of material and energy, lowering of emissions, protection of human health and creation of jobs and employment opportunities" (Elagroudy et al., 2016). Table 1 shows that greening the solid waste sector is recognized to contribute to the goals and targets of the SDGs.

The transition of the green solid waste sector to a green economy. The United Nations Environment Program (UNEP) (2010) defines a green economy as an "economy that results in improved human well-being and reduced inequalities over the long term, while not exposing future generations to significant environmental risks and ecological scarcities." With human beings at the core of the green economy, the role of engaging the community in SWM becomes a sustainable mechanism to ensure the greening of the solid waste sector.

Elagroudy et al. (2016) also emphasized that greening the waste sector also capitalizes on an SWM plan where benefits can "maximize economic, environmental, and social benefits at a reasonable cost for current and future MSW generation…." Tulebayeva et al. (2020) emphasize that a green economy involves growth in income and employment due to public and private investments in sectors such as reducing environmental risks, including waste management improvement.

Zhu et al. (2008) established the sustainable and integrated SWM (SISWM) or Green SWM. The SISWM requires the following: "a) an essential part of successful local governance; b) emphasizes stakeholder participation and involvement; c) ensures occupational health and safety; d) provides economical service delivery; e) guarantees cost recovery; f) performed in an environmentally friendly manner that minimizes resource use and maximizes resource recovery; g) contributes to job creation in the sector itself and encourages services and products in other sectors and industries, and h) helps reduce the financial pressure on governments." (Zhu et al., 2008).

The SWM sector is also believed to contribute to the green economy when it meets the requirements of the three pillars of sustainable development—social, environmental, and economic (Elagroudy et al., 2016). Table 2 presents the pillars of sustainable development and how the SWM sector can achieve these pillars.

2.3 Local SWM in the Philippines

Waste generation. The Philippines registered annual trash of 14.66 million tons (UNEP, 2010, as cited in Bagayas, 2020). The Environmental Management Bureau (EMB) projected that the annual volume of waste generated would surge to 18.05 million tons in 2020. In terms of waste composition, the National Solid Waste Management Commission (NSWMC) reported that disposed waste is dominated by biodegradable waste (52%), followed by recyclable waste (28%), and residuals (18%). The sources of biodegradable waste include wastes from yards and households' kitchens like food, among others. Recyclable

Table 1 Contribution of the solid waste sector to the SDGs

Sustainable development goal	Contribution of the solid waste sector to the SDG
No poverty (goal 1)	By achieving full and productive employment and decent work for all MSW sector workers, including women and young people
Good health and well-being (goal 3) and decent work and economic growth (goal 8)	By improving the labor conditions and working environment for workers in the MSW sector. In addition, proper waste management leads to healthy water and food, which in turn enhances the health of human beings
Affordable and clean energy (goal 7) and Sustainable cities and communities (goal 11)	By integrating the principles of sustainable development into the country's policies and programs. Greening the MSW sector will also reverse the loss of environmental resources by following the solid waste hierarchy and encouraging the concept of the three Rs: reuse, recycle, and recover
Responsible consumption and production patterns (goal 12)	By substantially reducing waste generation through prevention, reduction, recycling, and reuse
Climate action (goal 13)	By reducing GHGs in the solid waste sector and its impacts
Partnership for the goals (goal 17)	By providing international funding, new technologies, information, and communications to private and governmental sectors in developing countries

Source Elagroudy et al. (2016)

wastes, on the other hand, comprise items like metals, plastic packaging, leather, and so on.

In response to the anticipated growth in the quantity of waste generated, the Ecological SWM Act required the LGUs to formulate a local SWM plan that details the reuse, recycling, and composting of waste, with the NSWMC serving as the approving and overseeing entity in implementing SWM plans. However, since November 2020, only 62% or 1000 of the 1634 LGUs have approved 10-year SWM plans. This scenario is attributed to limited funding, space availability, and resources (Ranada, 2014). Sanitary landfills are lacking in many LGUs. This scenario poses potential environmental and human health risks due to untreated solid waste and the absence of residual waste recovery. In addition, many sanitary landfills are reaching their maximum capacity. The Ecological SWM Act of 2000 enjoins all sectors of society to participate in the successful implementation of the SWM program.

Solid waste infrastructure. The LGUs are required by the Ecological SWM Act to establish SWM facilities like MRF to process compostable and recyclable materials. As specified in Article 6, section 37 of the law, LGUs have until 2004 to convert their open dumpsites into sanitary landfills. As of 2018, only 10,730 MRF facilities in the Philippines service about 33.3% of the 42,046 *barangays* (Ranada, 2014). The gap can be explained by insufficient funds to put up an MRF. According to Ranada (2014), a functional MRF costs around half a million to be installed, coupled with the annual salaries of garbage collectors of PhP960,000 (19,200 USD).

Due to the absence of standards in establishing disposal facilities, different LGUs constructed MRFs based on their capability and requirements. Some build a combination of recycling and composting facilities, others build just a *barangay* recycling facility, and others a communal bin or market composting.

Budgetary constraints pushed some LGUs to collect fees on garbage collection. They also impose fines on violators, sell recyclables, produce composed fertilizers for sale, charge fees on special waste collection, and lease facilities to private individuals, even though transfer station is not popular in the country (Lapid, 2007).

Compliance with the SWM law. The Local Government Code (Republic Act 7160) states that "LGUs shall be primarily responsible in the implementation and enforcement of the provisions of the law within their respective jurisdictions." At the local level, the SWM law (RA 9003) states that "the *barangay* (village) handles the segregation and collection of solid waste specifically for biodegradable, compostable, and reusable wastes. The collection of non-recyclable materials and special wastes shall be the responsibility of the municipality or city."

At the *barangay* (village) level, compliance is primarily determined by strict observance of some provisions of the Ecological SWM Act and its implementing rules and regulations (IRR). Section 6 of the IRR requires *barangays* (villages) to create their SWM Committee. The *Barangay* SWM Board has the following functions and responsibilities: (a) formulate an SWM program consistent with the city/municipality plan; (b) segregate and collect biodegradable, compostable, and reusable wastes; (c) establish MRF; (d) allocate *barangay* funds; (e) look for sources of funds; (f) organize core coordinators; and (g) submit a monthly report to the city or municipality.

Table 2 Requirements of the three pillars of sustainable development for the SWM sector

Pillars of sustainable development	Basis of the SWM sector in achieving the pillars of sustainable development
Economic sustainability	• The waste sector cost effectively generates secondary material, establishes new enterprises, provides more jobs, supplies affordable carbon–neutral energy, and minimizes the amount of residual waste disposed of • Funds and investments must be directed to appropriate practices, infrastructure, equipment, and affordable services to operate and maintain over their lifetime • Wherever possible, economic investments should encourage local technologies and enterprise financing
Social sustainability	• Working conditions in the waste sector are safe and healthy for employees and the public • Employment in the green economy also needs to be concerned with other social factors such as child labor, social protection, and freedom of association
Environmental sustainability	• Resources should undergo life cycle analysis, starting with the production and manufacturing sectors, to promote the production of non-hazardous goods and materials, resulting in the least amount of waste generated • Sustainable consumption should be promoted by addressing the consumer side by implementing waste prevention strategies

Source Elagroudy et al. (2016)

3 Research Method

3.1 Research Framework

Theoretical basis. The study is anchored on the Participation Theory and the Community Participation Approaches. These guided the authors in analyzing community participation in implementing local SWM and its contribution to greening the local solid waste sector (SWS).

The Participation Theory. The participation theory builds up on the concepts and principles of community participation, which may come in different typologies and approaches depending on the type of project and the nature of the partnership between institutions and the community, government and the public, and non-government organizations (NGOs) and the people (Abrams & Kolodny, 1971). There are four approaches to community participation. These include contributions, instrumental, community empowerment, and developmental processes.

The contributions approach is defined by Preston et al. (2009) as "the type of participation which considers involvement mainly as voluntary contributions for an activity." The contributions might be in the form of devoting time to the activities of the project, and it might be in kind, resources, or monetary, or it might be in the form of sharing knowledge with a fellow community member. It is a process wherein the community as a participant of the program shall be guided or mentored by an expert or an authority on the subject activity or project. This professional mentor or leader typically comes from outside the community and will oversee the entire program and decide how the community's contributions will be put into proper perspective or use. Figure 1 shows the components of the contributions approach.

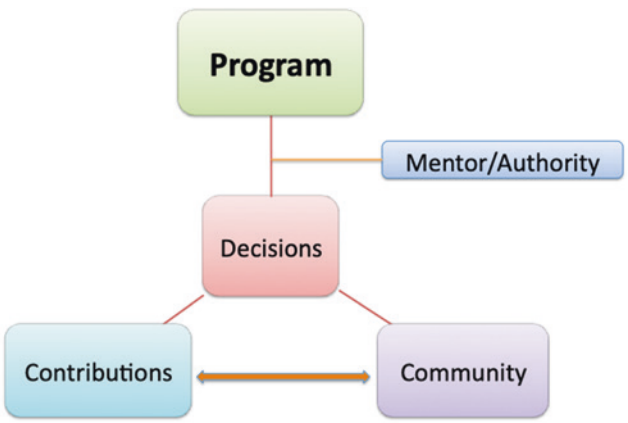

Fig. 1 Contributions participation approach (authors' construct)

Preston et al. (2009) characterized the instrumental approach where community participation is geared toward achieving results from intervention to planning and development. He viewed community empowerment as a means by which communities are empowered to solve issues and challenges. The developmental approach involves the community in the conceptualization of development and decision-making guided by the principles of social justice.

Conceptual framework. Among the four approaches to community participation, the contributions approach is adopted in assessing community participation in local SWM. In practice, a top-down contributions approach is applicable in local SWM where the community participates in waste segregation supervised by authorities or technical support in composting biodegradable waste from an expert of the national government agency. The community voluntarily devotes time for meetings, lectures, money, and resources to conduct composting activities. In this case, the contributions approach is seen as a "mentoring" type of participation by a community in a government-led action to attain a common objective.

The Participation Theory can be analyzed by looking at the various stakeholders in implementing the SWM at the local level. Figure 2 shows the key actors in the SWM implementation, including the LGUs and the village officials.

The participation of the community can be evaluated based on the provision of Section 10 of the Ecological SWM Act. It specifies that the LGUs shall be primarily responsible for the implementation and enforcement of the requirements of the act within their respective jurisdictions.

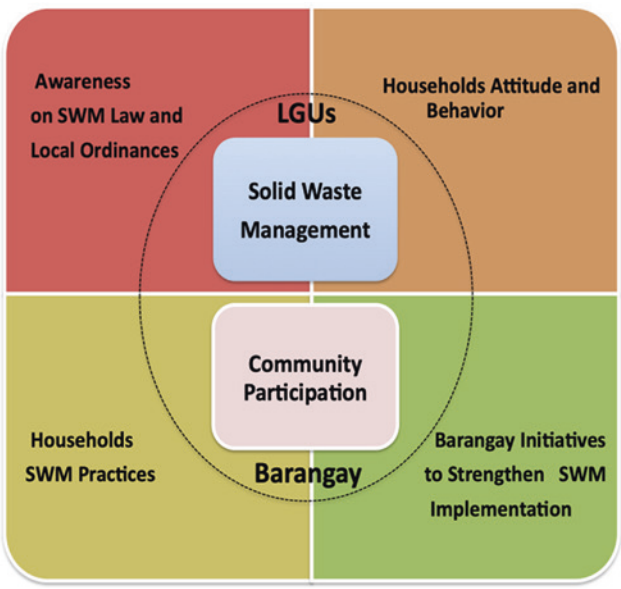

Fig. 2 Conceptual framework (authors' construct)

The assessment of community participation covers four key areas. These include knowledge and awareness of SWM law and local ordinances, households' attitude and behavior, SWM practices, and the village initiatives to strengthen the implementation of SWM.

3.2 Developed Questionnaire

There were two sets of questionnaires developed for the study. One set was for the household survey and the other for the key informant interview to include the village officials and the garbage collectors.

The first set of questionnaires was structured in the following manner: (1) socioeconomic profile of the respondents; (2) familiarity, awareness of, and compliance of the respondents with the SWM law and local ordinances; (3) willingness to participate in and pay for the services of the village's SWM program; (4) perception of the respondents on the efficiency of implementing the SWM law; and the (5) recommendation on how to improve the implementation of SWM in the village. The fourth part of the questionnaire established the alignment of the SWM implementation with the SDG, Green SWM and pillars of sustainable development, as well as the analysis of the strengths, weaknesses, opportunities, and challenges (SWOC) of the local SWM program.

The second set of questionnaires defined the perceptions of the village officers and garbage collectors on community participation in SWM implementation. Further, the questionnaire also included the recommendations of the respondents on the enhancement of SWM implementation at the village level.

3.3 Case Study

The study area is *Barangay* Tuntungin-Putho in the Municipality of Los Baños, Province of Laguna in the Philippines. Figure 3 shows the map of the study area.

The chosen study site is one of the 13 *barangays* of the Municipality of Los Baños, with a population of 9231 in 2018, as given in Table 3. The village is the fourth-largest population and is one of the three (3) *barangays* with its garbage truck used for solid waste collection. It is also one of the top performers in terms of SWM implementation in the municipality.

Based on the 2018 *Barangay* Monitoring System (BMS), the total volume of biodegradable wastes generated by the community is approximately 1795.92 kg/day, while the non-biodegradable and recyclables combined are only 630.14 kg/day. The Municipality of Los Baños has an approved 10-year SWM plan as required in Section 16 of the Ecological SWM Act.

Instrumentation. The convenience sampling method was utilized in choosing the respondents. According to Dudovskiy (2017), convenience sampling, or availability sampling (accidental sampling or grab sampling), is a manner of sampling dependent on conveniently available participants in collecting data, with no statistical probability involved in selecting the sample population.

The respondents were interviewed face to face. The critical issues in compliance with the Ecological SWM Act and local ordinances were generated from the municipality's 10-year SWM plan covering the period from 2014 to 2023. This conveys the situation in managing solid waste at the local level.

Data analysis. Based on the structure of the questionnaire, the efficiency of the implementation of the SWM law (fourth part of the first set of the questionnaire) was used to establish the alignment of the SWM implementation with the SDG as well as its SWOC. For the former, the parameters of Elagroudy et al. (2016) in greening the SWS with their contribution to the goals and targets of the SDGs were used in the analysis.

The FGD and the interview with the *barangay* officials were utilized to analyze the SWOC in the implementation of the local SWM activities. The efficiency of SWM implementation was also evaluated using the SWOC framework. This framework established the weaknesses and challenges as the basis of crafting local strategies that enable community participation in the local SWM program, as described in Table 2.

The following focal areas of the Contributions Approach were used for the SWOC analysis of implementing the local SWM:

- *Provision of time*. The community devotes time to attending meetings, seminars, and other related activities.
- *Provision of resources*. The community allocates funds/equipment for the program.
- *Provision of community-based knowledge*. The community member shares expertise/skills to fulfill a task for the program.

4 Results

4.1 Sample Composition

In this study, the sample respondents were generated from 1846 households following the BMS. The survey covered 100 respondents through convenience sampling, with 15 from the six *puroks* (districts) and the *barangay* officials representing the rest. Based on the authors' knowledge of the type of neighborhood in the study area, the chosen

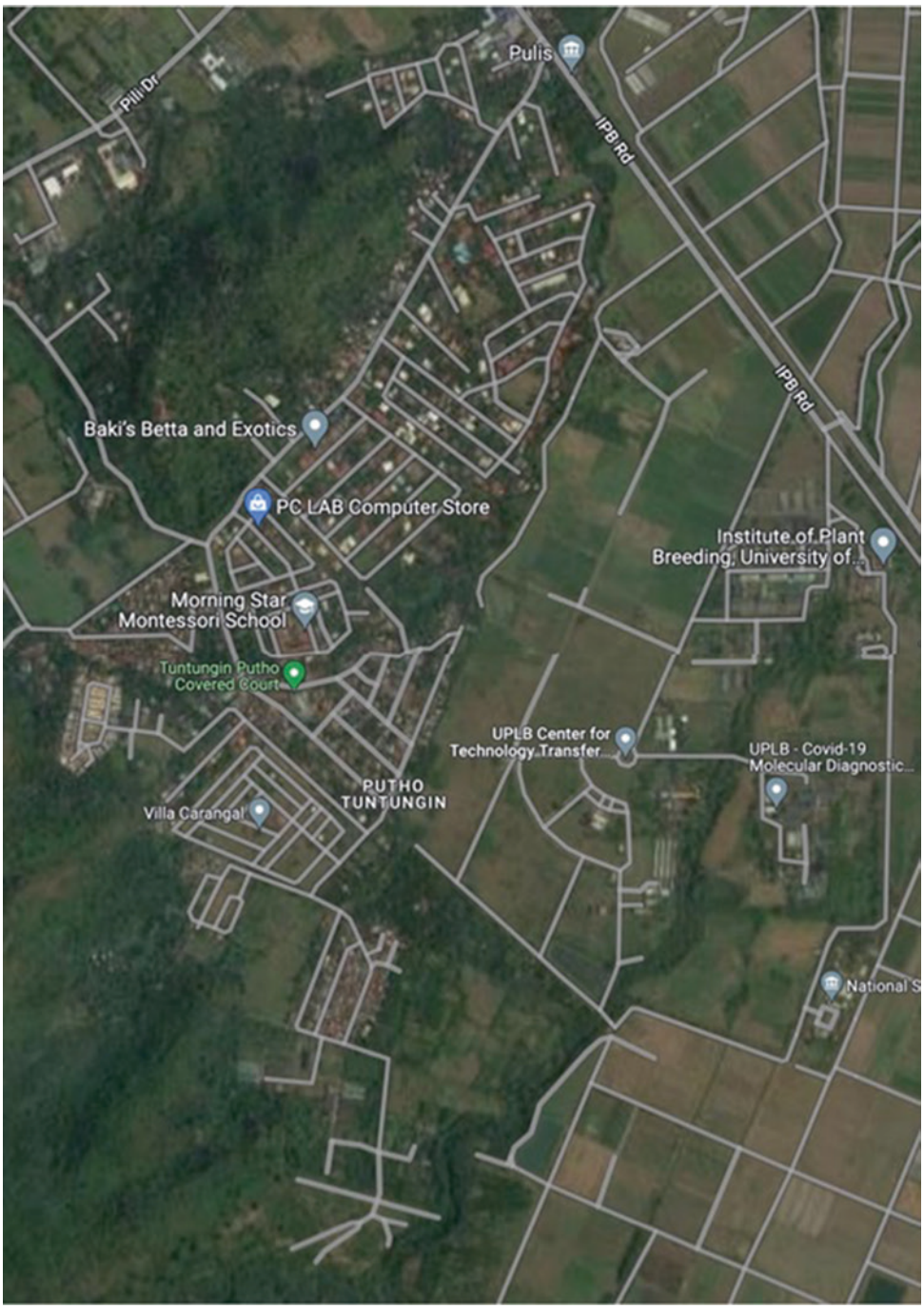

Fig. 3 Map of the study area

samples are believed to represent the total population, given the similarities in their traits. They are all part of the SWM initiatives of the village. The breakdown of the respondents is presented in Table 4.

4.2 Socioeconomic Profile of the Respondents

Most respondents are women (69%), and predominantly (78%) are married, as presented in Fig. 4. Notable age ranges between 45 to 54 years old (36%) and 55 to 64 years old (27%). A significant number (20%) belong to 35–44 years old. Around 11% of the respondents have ages ranging from 22 to 34.

In terms of education, more than half (52%) of the respondents are high school graduates. There are also college graduates at second (15%) and fourth (17%) year levels. Around 11% are elementary graduates.

Figure 5 presents that approximately 20% of the women are unemployed and serve as housewives. Others employed

Table 3 Total population and number of households by *purok* (ward), *Barangay* Tuntungin-Putho, 2018

Purok	Male	Female	Total population	Total households	Percent of total
1	835	864	1699	340	18
2	521	574	1095	219	12
3	851	827	1678	336	18
4	651	714	1365	273	15
5	1074	1101	2175	435	24
6	608	611	1219	244	13
Total	4540	4691	9231	1846	100

Source of basic data Barangay Monitoring System, 2018

Table 4 Sample composition is breakdown of respondents for the household survey

Purok	Male	Female	Total respondents
1	3	16	19
2	6	9	15
3	9	8	17
4	2	14	16
5	2	14	16
6	9	8	17
Total	31	69	100

are the variety store owners at 12%, while 10% are drivers and government employees. Other occupations stand at 6% and below.

Most respondents (80%) have a monthly income of PhP40,000 (800 USD) and below. The average income of the respondents was recorded at approximately PhP15,000 (300 USD) a month. This represented an annual per capita income of around PhP180,000 (3600 USD), which is below the 2012 per capita poverty threshold for the CALABARZON Region, equal to PhP229,644 (5593 USD) or PhP19,137 (383 USD) per month. It should be noted that more than half (52%) of the respondents finished high school and are generally considered low-income earners. A meager 4.0% belong to the PhP40,000–PhP50,000 (800–1000 USD) income bracket, while 3% have income between PhP100,000 (2000 USD) and PhP249,999 (5000 USD). The remaining 13% preferred not to answer the question.

Around 19% of the respondents have spouses who are not working, and the majority are housewives. Private employees came at third with 14%, household helpers turned up at 10%, followed by drivers and business owners with 7%. This denotes a variety of occupations of the respondents. However, the occupations are not high-paying jobs which can be attributed to the relatively low educational attainment of more than half (52%) of the respondents.

About 75% of the spouses have income below PhP40,000 (800 USD). A meager proportion (1–2%) have income ranging from PhP40,000 (800 USD) to PhP50,999

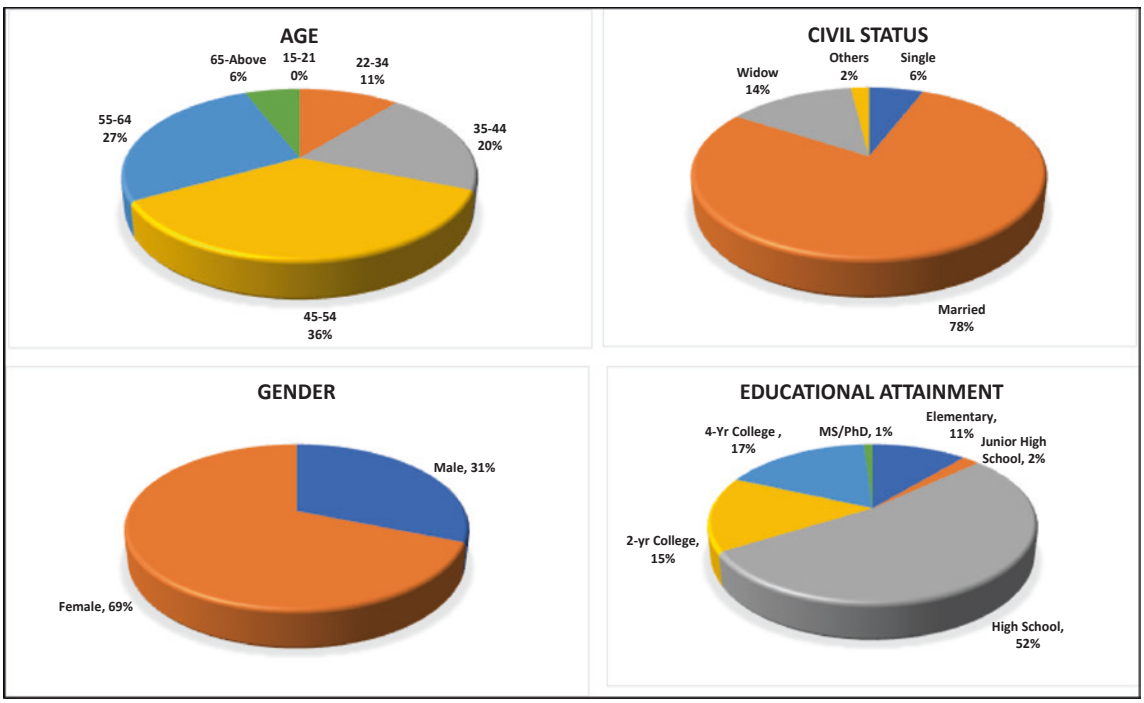

Fig. 4 Profile of the respondents

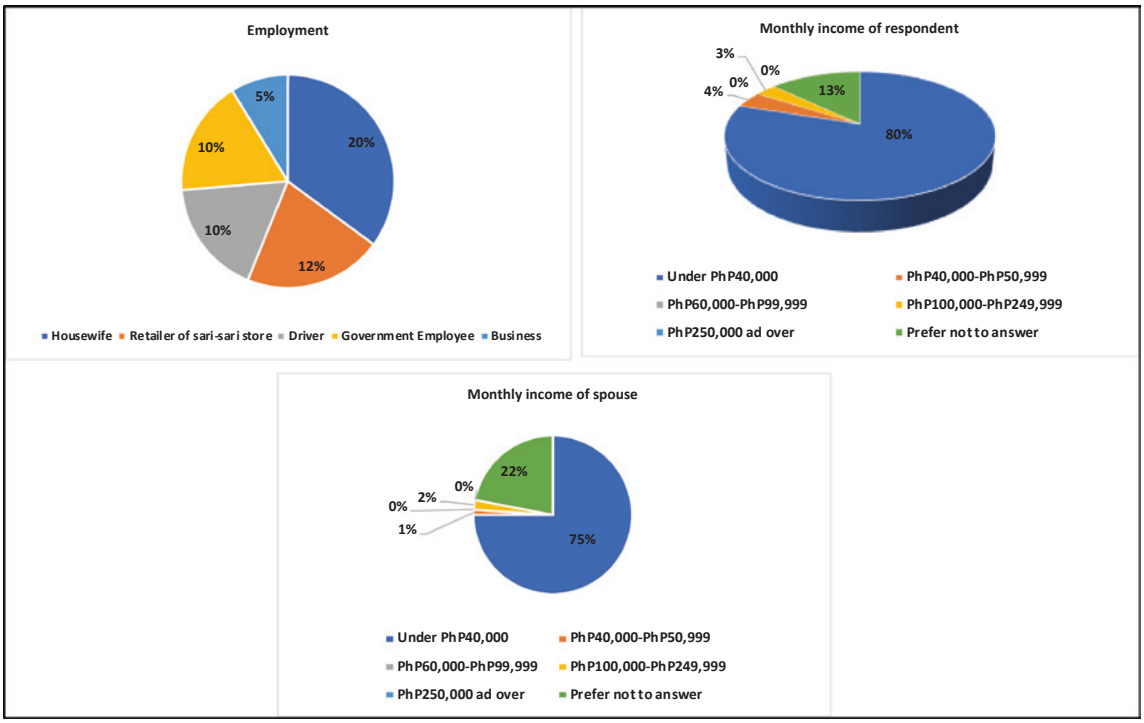

Fig. 5 Employment and income of respondents and spouses

(1020 USD) and from PhP100,000 (2000 USD) to PhP249,999 (5000 USD). The observed low income of the respondents can be partly attributed to the low educational attainment of half of the respondents.

4.3 Familiarity, Awareness of, and Compliance with SWM Law and Local Ordinances

Awareness of the Ecological SWM Act (RA 9003). In the household survey, Fig. 6 indicated that 61% of the respondents are highly aware of the Ecological SWM Act. This is followed by respondents who are moderately familiar with 25%, 8.0% are slightly aware, and 4.0% are somewhat aware. The respondents who are unaware of the law stand at only 2.0%.

Most respondents aged 45–64 are aware of the law, and most are female. Aminrad et al. (2011) indicated that the older respondents and women were seen to have higher abstract knowledge and were considered more active participants of the SWM program.

Almost the same figures were observed in the awareness of the local ordinance on SWM. The extremely aware respondents remain at 61% of the total respondents. A little difference was observed in the moderately aware at 21% of the respondents; the somewhat aware and slightly aware reached 3.0% and 7.0%, respectively. About 8.0% of the respondents are unaware of the local ordinance.

Awareness of the law (Clean Air Act or RA 8749) against garbage burning. A large proportion (96%) of the respondents are unaware of the supporting law (Clean Air Act) to the Ecological SWM Act, as described in Fig. 7. The former refers to the prohibition on the open burning of garbage. Nevertheless, all respondents recognized that it harms the environment and human health. Some others avoid burning waste to shun the complaint of their neighbors. The remaining respondents (4%) practice the open burning of dry leaves to shoo off dengue-causing mosquitoes. Practically, the awareness level of the supporting law is 100% since the burning of leaves is exempted in RA 8749.

According to 73% of the respondents, the primary reason for households' avoidance of the burning of garbage is the awareness of its negative impact on the environment and health as exhibited in Fig. 8. The second reason for not burning trash is the penalty for violating the law, as indicated by 37% of the respondents. Similarly, around 3% of the households do not burn their garbage because of complaints from neighbors.

Generally, compliance with the SWM law and ordinance is high (61%). Only a few do not comply since they do not want to be blamed by their neighbors who complained of the unfavorable smell of burned garbage. The *barangay*

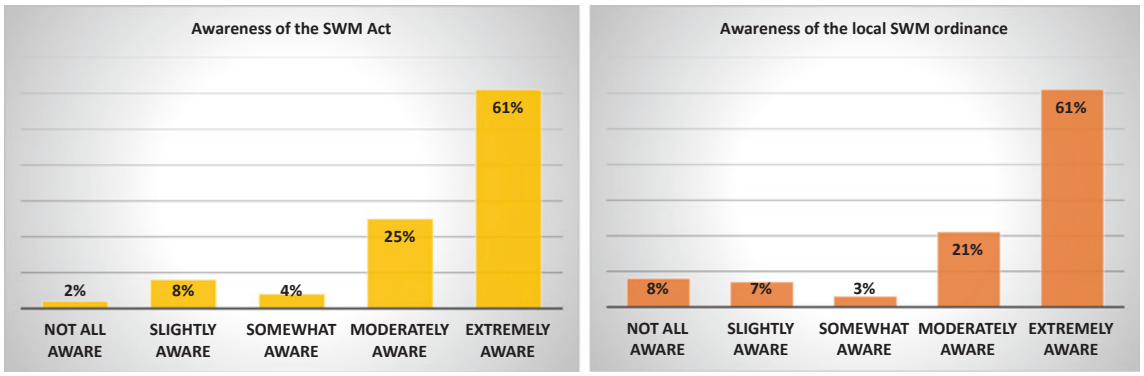

Fig. 6 Awareness of the SWM Act, local SWM ordinance, and garbage burning

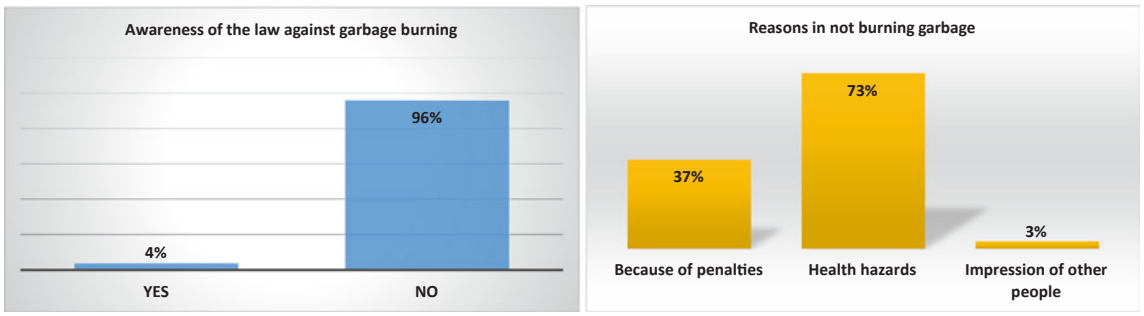

Fig. 7 Awareness of the law on the burning of garbage

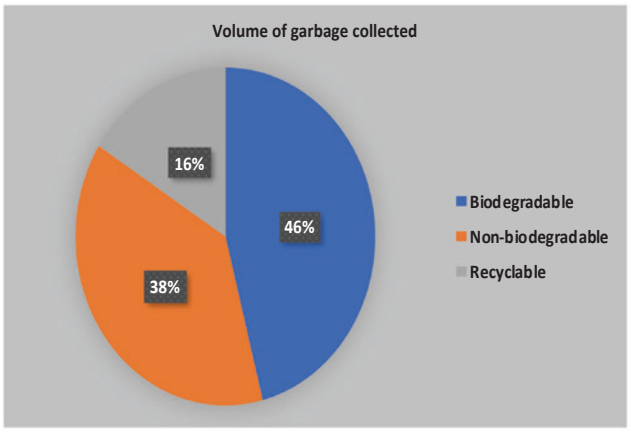

Fig. 8 Volume of garbage collected

officials believed that the residents were aware of the health hazards caused by the burning of waste.

A reasonably high (52%) proportion of the respondents are high school graduates. They already possess relatively high comprehension levels. The second (17%) group is composed of those who finished a 4-year course in college, while the third group (15%) represents those who completed two-year college. These clusters demonstrated better grasp or comprehension levels of the law. Based on Sudipta et al. (2016), the well-off and educated class are more willing to participate than those in the lower educated and poor classification.

Community participation in the implementation of the local SWM. The households perceived that their awareness of the law and the ordinances motivated them to reduce the volume of biodegradable waste generation further. Figure 8 illustrates that the household survey indicated that the volume of biodegradable waste generated, equal to 46%, is higher than that of non-biodegradable waste collected at 38% (Fig. 8). As perceived by the households, participation in the SWM initiatives like waste composting significantly reduced waste.

Awareness of likely consequences of behavior toward SWM implementation is recognized as a dominant factor in community participation. All the respondents avoided throwing their garbage anywhere (littering). They knew that it would cause environmental hazards, clog canals, and contribute to flooding. Others mentioned that mishandling of garbage contributes to an unclean environment, serves as eyesores, and causes infectious diseases.

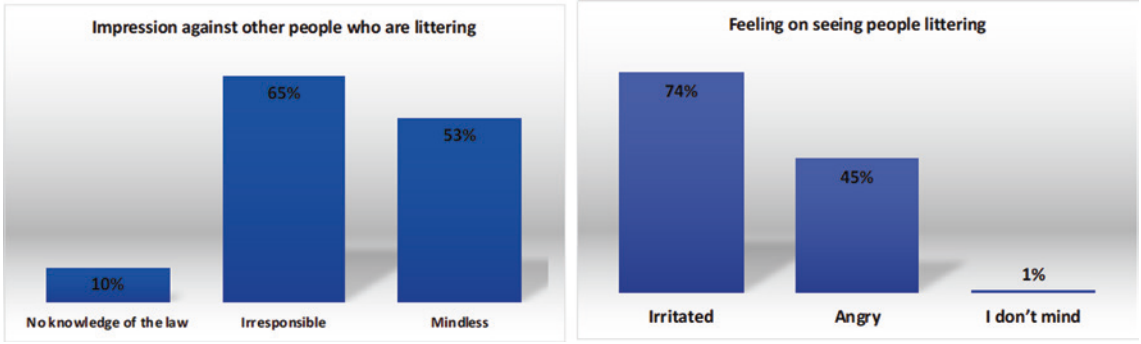

Fig. 9 Impressions on the attitude and behavior of others on SWM

Impressions on the attitude and behavior of others on SWM. Around 65% of the respondents recognized people dumping or throwing waste anywhere as senseless. More than half (53%) tagged them as not cautious, and the remaining 10% are treated as ignorant of the law, as shown in Fig. 9. These results substantiated the Theory of Planned Behavior (TPB) in implementing the SWM law and ordinances. The TPB asserted that the likely consequence of behavior influences an individual's behavior. When the respondents saw people who were littering, they felt irritated (74%) and angry (45%). A meager 1.0% just ignored this unpleasant behavior of other people.

Interest in voluntarily complying with the law. Figure 10 presents that around 55% of the respondents are dubious that residents will willingly follow the law without strict implementation of the ordinances. About half (45%) of the respondents thought otherwise, as long as there is good information and education campaign (IEC). This is evidence that compliance with the SWM law and ordinances will be challenging without strict implementation of the law and pertinent information and dissemination campaigns by the LGU.

4.4 Level of Community Participation in SWM Implementation

Other factors influenced community participation in local SWM. These include community acceptance of the strict implementation of waste segregation and community perception of the payment of garbage collection fees to ensure participation.

Community acceptance of the strict implementation of waste segregation. A great majority (99%) of the respondents strongly agree (58%) and agree (41%) with the strict implementation of waste segregation in every *purok*, as exhibited in Fig. 11. A meager 1.0% is still undecided on the matter. The survey generally contradicted the belief of the *barangay* officials that strict implementation of SWM ordinances will weaken their chances of being re-elected in future local elections.

Willingness to pay for SWM services. A large percentage (83%) of the respondents are also willing to participate in local SWM, including the payment of garbage collection

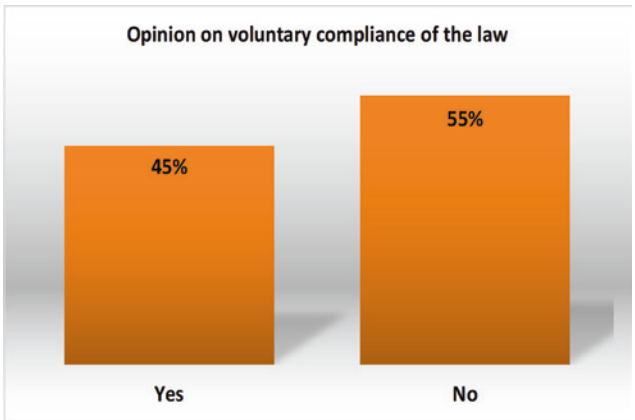

Fig. 10 Impressions on the attitude and behavior on compliance with the Ecological SWM Act

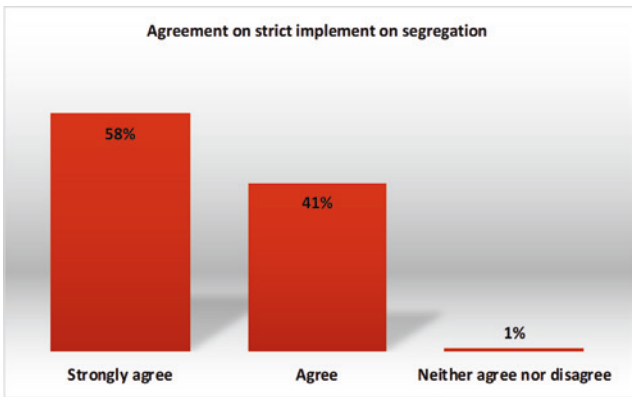

Fig. 11 Perception of strict implementation of waste segregation

fees, as presented in Fig. 12. The suggested amount of garbage collection fees ranges from PhP5.00 to PhP20.00 (0.10–4.0 USD) with a higher proportion for PhP5.00 (0.10 USD) (37%) and PhP10.00 (5.0 USD) (29%). However, 14% of the respondents are unwilling to pay garbage collection fees since they already pay income taxes. They believe that garbage collection is part of the local government's responsibility.

4.5 Efficiency of Implementing the SWM Law and Initiatives to Trigger Community Participation

The efficiency of implementing the SWM law and initiatives is analyzed based on the alignment of the SWM implementation with the SDG, Green SWM, and pillars of sustainable development, and the analysis of the SWOC of the local SWM programs.

Efficiency of local SWM based on alignment with SDG, Green SWM, and pillars of sustainable development. The efficiency of implementing the local SWM law and initiatives establishes the greening of the local SWM. Three key areas were assessed on this matter: (a) contribution of community participation in local SWM initiatives to the achievement of the SDGs; (b) alignment of the local SWM initiatives with the SISWM or Green SWM; and the (c) contribution of the local SWM to the green economy based on the pillars of sustainable development.

Contribution of community participation to local SWM initiatives for the achievement of SDGs. As emphasized by Elagroudy et al. (2016), the greening of the solid waste sector has to contribute to the attainment of the SDG (Goals 1, 3, 8, 7, 11, 12, 13, and 17). The assessment of the contribution of the Ecological SWM Act and the local SWM initiatives to achieving the SDG based on the interview with the households is summarized in Table 5.

Alignment of the local SWM initiatives with the SISWM or Green SWM: Emphasis on community participation. Zhu et al. (2008) underscored eight requisites for a SISWM or Green SWM. The analysis of the community participation in local SWM revealed that seven of the eight requisites are demonstrated in the local SWM initiatives of the village, as presented in Table 6.

Contribution of the local SWM to the green economy based on the pillars of sustainable development. Elagroudy et al. (2016) indicated that the "SWM sector would contribute to the green economy if….[…]….. it satisfies the social, environmental and economic sustainability." Table 7 demonstrates how the local SWM initiatives of the *barangay* are in harmony with the pillars of sustainable development to achieve a green economy.

Efficiency based on SWOC analysis of community participation. The SWOC analysis unfolded the focal areas of development planning of the community. The weaknesses and challenges are the triggers for the *puroks* (district) to implement and monitor the local SWM plan. The strengths and opportunities must be translated into actionable measures and resources that can be utilized by the community in addressing the constraints and challenges of local SWM. Table 8 presents the SWOC analysis on the implementation of the local SWM.

4.6 Initiatives of Local Officials on SWM for Community Participation

Information, education, and communication campaign. Information dissemination on SWM implementation is one of the initiatives of the community officials in the form of information, education, and communication (IEC) activities. More than half (51%) of the respondents shared that they received flyers and observed tarpaulin banners on the SWM programs of the local government, as presented in

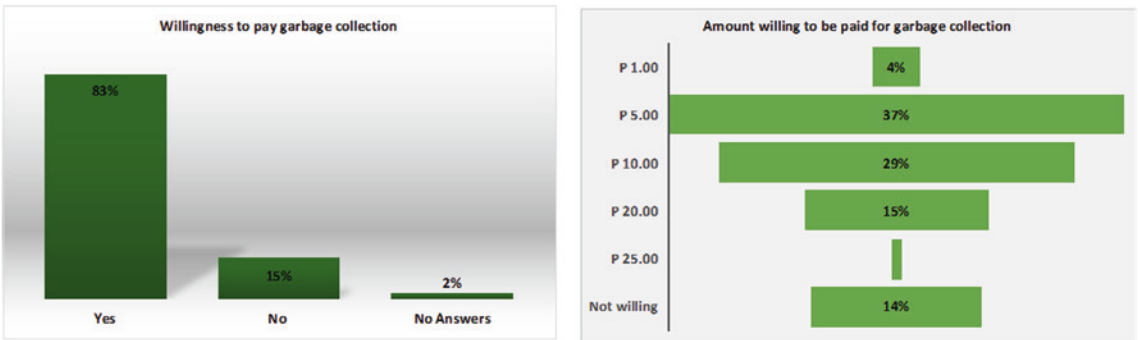

Fig. 12 Willingness to participate in SWM

Table 5 Contribution of the ecological SWM Act and the local initiatives in achieving SDG

Sustainable development goal[a]	Contribution of the solid waste sector to the SDG (Elagroudy et al., 2016)	Community participation in Ecological SWM Act and local SWM initiatives that are aligned with the achievement of the SDGs based on the household survey and key informant interviews
No poverty (goal 1)	By achieving full and productive employment and decent work for all MSW sector workers, including women and young people	• The *barangay* engages in livelihood development using recycled materials for artificial flowers, bags, and decorative stuff • Residents make handcrafted bags from paper trash and other scrap materials, marketed under the project, "*Bags for Life*" • Employment opportunities are expanded since the demand for the bags is increasing with orders from nearby municipalities and provinces and from "*balikbayans*" (a Filipino returning to the country after visiting another country) • Expansion of livelihood products to include native bags • The *barangay* explores using recycled/scrap materials in making chandeliers and flowers for aesthetics • The MRF in the village is an opportunity to create livelihood and employment • Mothers in the village make bags, plastic flower beads, and accessories from plastic bottles and scrap papers and sell them (Cardenas, 2018)
Good health and well-being (goal 3) and decent work and economic growth (goal 8)	By improving the labor conditions and working environment for workers in the MSW sector. In addition, proper waste management leads to healthy water and food, which in turn enhances the health of human beings	• Local officials strive to achieve a zero-waste disposal community • The *barangay* and the households minimize waste generation and disposal • Local officials voluntarily provide an additional amount for garbage collectors from personal funds
Affordable and clean energy (goal 7) and Sustainable cities and communities (goal 11)	By integrating the principles of sustainable development into the country's policies and programs. Greening the MSW sector will also reverse the loss of environmental resources by following the solid waste hierarchy and encouraging the concept of the three Rs: reuse, recycle, and recover	• Biodegradable wastes are turned into vermicompost, which is combined with eco-blocks for landscaping • Task force development of the village regularly gathers the waste materials in the community and sorts them based on three classifications of waste: recyclable, biodegradable, and non-biodegradable • Biodegradable materials are used to fertilize the plants
Responsible consumption and production patterns (goal 12)	By substantially reducing waste generation through prevention, reduction, recycling, and reuse	• Local officials promote using eco-blocks (eco-bricks) made from cleaned plastic bottles filled with non-biodegradable wastes. These are used in landscaping initiatives
Climate action (goal 13)	By taking actions to reduce GHGs in the solid waste sector and its impacts	• The *barangay* plans to produce biogas from kitchen waste. Biogas is a "renewable source of energy..[..].. which can reduce GHG emission" (Tanigawa, 2017)
Partnership for the goals (goal 17)	By providing international funding, new technologies, and information, and communications to private and governmental sectors in developing countries	• *Barangay* conducts the Green Gardening Project to influence the youth to plant vegetables and properly manage waste disposal. This involves a partnership between the Los Banos Gender and Development (GAD) Office (Cardenas, 2018), which provided the seeds for gardening such as squash, taro, bitter gourd, horseradish, eggplant, and gourd

(continued)

Table 6 Green SWM requisites that demonstrated community participation in local SWM initiatives of the case study village

Requisites of Green SWM	Community participation in the ecological SWM Act and local SWM initiatives and alignment with the requisites of Green SWM based on household surveys and key informant interviews
An essential part of successful local governance	• A majority (75%) of the respondents generally assessed that the SWM implementation strategies of the *barangay* are effective • The *barangay* is targeting zero-waste disposal • The local officials have initiated several programs and projects to strengthen awareness of solid waste reduction and conversion
Emphasizes stakeholder participation and involvement	• A majority (99%) of the interviewed respondents strongly agree (58%) and agree (41%) with the strict implementation of waste segregation • Participation of the community in local SWM was influenced by awareness and knowledge of the law and by the *barangay's i*nformation dissemination and implementation initiatives • High awareness level was viewed as one of the factors in the participation of the community in the implementation of the SWM law, specifically on segregating wastes
Emphasizes occupational health and safety	• There is a plan to provide protective gear (mask, gloves, boots) and equipment to garbage collectors
Provides economic service delivery	• Waste management is translated to income and food generation, where the community engages in livelihood opportunities to make and sell waste products (bags, flower beads, and accessories, among others) • Waste is turned to vermicompost for vegetable gardening
Guarantees cost recovery	• The *barangay* makes native bags, artificial flowers, and decorative stuff for sale • The *barangay* introduces the "*Barangay Plastic sa Bote Program*," wherein plastic trash will be put inside an empty 1.5-L bottle to be used as "eco-blocks"
Performed in an environment-friendly manner that minimizes resource use and maximizes resource recovery	• Production of compost fertilizers from biodegradable waste • Implementation of "disposal of segregated garbage at the *barangay* designated place, on designated day and time only"
It helps reduce the financial pressure on governments	• Local officials voluntarily provide an additional amount for garbage collectors from personal funds due to the limited budget of the LGU to compensate the garbage collectors

Table 7 Alignment of the SWM initiatives of the village with the pillars of sustainable development

Pillars of sustainable development (Elagroudy et al., 2016)	Community participation in the case study area that reflects the achievement of the pillars of sustainable development in local SWM
Economic sustainability	• The local SWM creates livelihood opportunities that enable the community residents to realize income and engage in food production
Social sustainability	• Personal protective equipment will be provided to waste handlers/collectors to avoid potential exposure to health hazards • Women and youth participate in making recyclable products such as bags, artificial flowers, and native bags, among others • Attendance by all *barangay* officials and a few community members in seminars carried out by the Municipal Environment and Natural Resources Office (MENRO) on SWM implementation
Environmental sustainability	• The *barangay* has a plan to produce biogas from kitchen waste • The *barangay* produces compost fertilizers derived from biodegradable waste • The households produce vegetable seedlings utilizing compost fertilizers • Implementation of "no segregation, no collection" policy in some areas of the *barangay,* such as the *Gawad Kalinga* housing project and subdivisions • The *barangay* regularly reminds households found to be habitually not properly segregating their wastes

Fig. 13. Close to half (49%) provided a negative response. This can be partially construed as a weakness of the LGU in its IEC campaign on SWM. In the 10-year SWM Plan, the municipality is responsible for conducting the IEC of the program with the *barangay* as the critical partner. Thus, it can be deduced that success in implementing SWM at the *barangay* level heavily relies on the municipality's leadership in terms of the IEC program and project implementation.

A majority (75%) of the respondents generally assessed that the SWM implementation strategies of the *barangay* are effective. At the same time, 25% remarked on the strategy's ineffectiveness since there are still residents in the community who do not diligently follow proper waste

Table 8 SWOC analysis of the implementation of the local SWM

Provision of time *(The community devotes time to meetings, seminars, and other related activities)*	
Strengths • Frequent visits/meetings between the local environment office (MENRO) and the *barangay* council on the implementation of SWM activities • There is time allocation for an effective garbage collection of five times a week • Participation of the *barangay* in the first *Fiesta ng Kalikasan* (Environment Feast) conducted by the LGU • Attendance of *barangay* officials and community members in the LGU-led training/seminar on (a) livelihood projects, (b) composting, and (c) SWM implementation • Participation by the *barangay* officials in the LGU-led IEC for the different schools in the *barangay* • Participation of the different community sectors (senior citizens, women, *barangay* athletes, and youth) in the flower-making project using recycled materials from trash • Participation of the community members in a *barangay*-led gardening project utilizing compost materials from garbage • Participation of the community in the *Barangay Plastic sa Bote* Project	*Weaknesses* • Non-promulgation of a *barangay* ordinance on SWM • There were times that garbage was not collected due to a defective dump truck • Not all households were reached by information dissemination on SWM • The hectic work schedules of some *barangay* officials prevented them from attending the SWM IEC activities of the *barangay* • The majority of the residents have no time to participate in *barangay*-initiated SWM programs and projects • Non-cooperation of some residents in segregation and proper disposal of garbage • Non-participation of some residents/establishments in the "no plastic" policy of the LGU
Opportunities • Presence of external support from the municipality for the maintenance of dump truck • Availability of external technical support from the private entities in conducting livelihood training for residents • Presence of external support (equipment) from institutions around the area	*Challenges* • Absence of external support to enhance compliance with waste segregation • Lack of external support to conduct composting at the community level
Voluntary provision of resources *(The community allocates funds/equipment for the program)*	
Strengths • *Barangay* allots resources for an effective garbage collection system five times a week • *Barangay* allocates resources to train some residents in livelihood projects • Residents allot money to buy sacks for their garbage • Residents in subdivisions pay voluntary monthly dues as their token to the *barangay* for the collection of their garbage • Some residents provide financial support or token to garbage collectors to alleviate their meager salaries	*Weaknesses* • Irregular and insufficient provision of protective paraphernalia to garbage collectors • Non-provision of training in waste handling for garbage collectors as required by the law • Non-allocation of resources by some residents in buying sacks makes their garbage vulnerable to stray dogs • Irregular receipts of assistance from the LGU
Opportunities • Provision of monetary/materials support by other institutions to the *barangay* • Allocation of funds by the LGU as assistance in the repair and maintenance of the b*arangay* dump truck • Offering by the LGU for a 50/50 sharing to purchasing another dump truck for the use of the *barangay*	*Challenges* • Irregular receipts of assistance from supporting institutions • Irregular/insufficient support from the LGU
Provisions of community-based knowledge *(The community member shares knowledge/skills to fulfill a task for the program)*	
Strengths • Some skilled residents assist in the construction of the *barangay* MRF facility • The *barangay* captain shares knowledge of gardening and composting activities of the *barangay*	*Weaknesses* • Scarcity of volunteer residents in carrying out *barangay* programs and projects on SWM
Opportunities • Availability of private individuals from institutions that conducts livelihood projects for the *barangay* to enhance community-based livelihood skills	*Challenges* • The inadequate number of external experts who can share skills and knowledge on SWM

segregation. To address this, the *barangay* officials need to assign *barangay tanod* (enforcers) who will monitor waste segregation during garbage collection.

The survey revealed that 52% of the respondents had observed *barangay* officials who went around their areas to disseminate information on appropriate segregation. Around 48% of the surveyed households did not witness the mentioned activity. Aside from distributing information materials, the *barangay* officials either conducted house-to-house visits or adopted a public announcement (PA) system to remind the residents about proper segregation. Generally, this *barangay* activity is an effective alternative

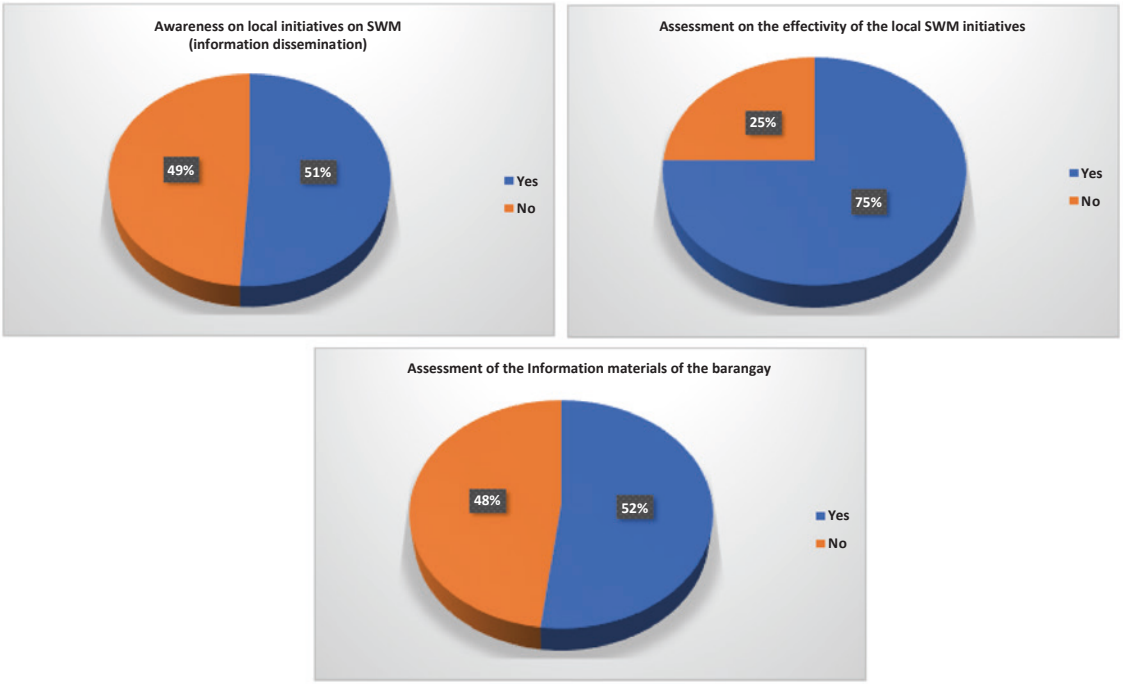

Fig. 13 Awareness of local SWM initiatives of the local officials and assessment of their effectivity

to the distribution of tarpaulin and flyers, which is believed to be a very effective means of information dissemination. Some *barangay* officials also suggested that tarps should be placed in strategic areas of the community to enhance information dissemination.

Local officials' assessment of community participation in SWM implementation. The local officials believed that community participation in SWM reflects the residents' adherence to the waste disposal schedule, placement of the garbage at the designated pickup points, and segregation of biodegradable and non-biodegradable wastes. Community participation is also evident when community residents practice composting waste in their backyard.

Local SWM initiatives to entice community participation in the implementation of the SWM. The SWM strategies of *barangay* Tuntungin-Putho are a component of the 10-year SWM plan of the municipality of Los Baños, Laguna. The plan covers 2014–2023 as approved by the NSWMC on September 30, 2014.

In the local SWM Plan, the *barangay* must address the SWM issues in its programs and activities. Measures such as the imposition of garbage collection fees were covered in the plan to reduce expenditures on solid waste collection and handling. There should be a house-to-house garbage collection during the daytime and imposition of the policy on the "no segregation, no collection" system. The plan also emphasized that the *barangay* should ensure that the households comply with the segregation policy even if garbage is collected at night.

Local SWM strategies. The interview with the *barangay* captain and his council implied that several SWM programs and projects had been initiated to strengthen the awareness and participation of the residents in solid waste reduction, reuse, and recycling. He enumerated the following measures:

- Engage in livelihood projects that utilized recyclable waste in making artificial flowers, bags, decorative stuff, and rags
- Produce compost fertilizers from biodegradable waste
- Produce vegetable seedlings using compost fertilizers and distribute them to interested residents who are into backyard gardening
- Introduce the *"Barangay Plastic sa Bote Program*," wherein plastic trash is placed inside an empty 1.5-L bottle to be used as "eco-blocks." Eco-blocks are used in constructing display booths during the celebration of the Bañamos Festival every September.

In terms of proper waste disposal and segregation, the *barangay* captain and his council spearheaded the following activities:

- Implementation of the disposal of segregated garbage at the designated place and prescribed schedule
- Implementation of "no segregation, no collection" policy in some areas of the *barangay,* such as in housing projects and subdivisions
- Continuous information dissemination on proper segregation by talking personally with households who are found to be habitually not following proper waste segregation.

Information dissemination. The IEC is done by the local environment office (MENRO) with the assistance of the *barangay*. The IEC covers recycling, reduction at source, and composting. The MENRO handles the non-biodegradable and residuals to be brought to the municipal MRF and eventually to the sanitary landfill.

5 Conclusions

The study generally revealed that community participation contributes to the greening of the local SWM given the following scenarios: (a) the households have a high level of familiarity, awareness of, and compliance with the law and ordinances, which motivated them to reduce the volume of waste generated and participate in SWM initiatives; (b) households are willing to pay for SWM services such as garbage collection in recognition of the importance of proper waste management in ensuring human health and protecting the environment, and (c) efficiency of implementing the SWM law and initiatives. In terms of efficiency, the study demonstrated the following: (a) the local SWM generally contributed to the achievement of SDG 1, 3, 8, 7, 11, 12, 13, and 17; (b) satisfied most of the requisites of SISWM or Green SWM, and demonstrated harmony with the pillars of sustainable development (social, environmental, and economic) to achieve a green economy; and (c) the SWOC provide opportunities to translate weaknesses and challenges to strategies for local SWM. Thus, community participation should be centric on local SWM development planning to attain a zero-waste community, promote green jobs in the SWS, and provide incentives to communities that generate these jobs.

Acknowledgements The authors would like to express heartfelt gratitude to *Barangay* Chief Officer Ronald Oñate, who unselfishly and expeditiously granted the requests for data. This gratitude also extends to the residents of *Barangay* Tuntungin-Putho who served as respondents in the survey; the members of the *Barangay* Council, especially councilor Ambet Narredo for their readiness and enthusiasm in giving the necessary information for this study.

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