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Research Article

Assessing the Compliance of a Coastal Municipality to the Ecological Solid Waste Management Act of 2000 (RA 9003)

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Abstract

To bring about a significant change in the SWM situation in the Philippines, the Ecological Solid Waste Management Act of 2000 (RA 9003) was enacted to provide local government units with frameworks that would help them solve the looming garbage problem in the country. Despite the presence of the decree, managing wastes remains a problem in the country particularly in the CALABARZON. This study was conducted to assess the extent of compliance of a coastal municipality to RA 9003 in terms of institutional mechanism, comprehensive solid waste management, incentives, and financial solid waste management and compare the assessments of 72 public officials, 396 residents, and 126 business establishments regarding the local government units' compliance. The research utilized a descriptive design and gathered data using the questionnaire complemented with interview and focus group discussion. Frequency, weighted mean, standard deviation, ANOVA and Scheffe's Test were used in treating the gathered data. Results revealed that Calaca has not fully complied with RA 9003. The solid waste management (SWM) implementation in the component barangays and waste segregation are not strictly monitored. There is weak enforcement of waste segregation, provision of appropriate bins, technical capacity of waste handlers, and utilization of the materials recovery facilities. Waste collection remains the primary issue in the city. The assessments of the officials, residents, and establishments regarding Calaca's compliance with institutional mechanisms, financial SWM, and incentives significantly differed despite their agreement regarding comprehensive SWM, indicating a low level of awareness among stakeholders and a weak SWM system.

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Introduction

The challenge of managing and solving waste problems is an urgent and pressing concern for municipal governments. Rapid population growth, economic development, and urbanization result in an increasing volume of generated solid waste [1–2] that could go beyond their capacity to control and handle them. The escalation of solid waste causes a sharp increase in waste buildup, widespread use of open dumps, the declining capacity of sanitary landfills as final disposal facilities, difficulties in establishing new dumpsites, and the rising costs of waste disposal. These make solid waste management (SWM) difficult, particularly among developing countries [3] like the Philippines. Moreover, mismanaged waste leads to the deterioration of the environment, causing air, water, and land pollution, which poses environmental and health risks [4–5]. These SWM concerns will continue to persist unless given consideration and planning [6].

In the Philippines, managing solid waste is primarily the responsibility of the municipalities [2, 7–9]. These local government units (LGUs) are the lead implementers of national policies and programs on waste management [9–10]. They are likewise mandated to formulate and enforce regulatory mechanisms, plans, and initiatives

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to address the worsening waste problem [11]. In complementation with the Local Government Code of 1991 or RA 7160, the passage of the Ecological Solid Waste Management Act of 2000, or RA 9003, on January 26, 2001, further strengthened these mandates for the LGUs. The act provided municipalities with a legal framework that would help them solve the looming garbage problem in the country along with the environmental and health impacts. It also offers a detailed guide to resolving SWM problems and gives comprehensive, systematic, and ecological procedures for collecting, handling, storing, and disposing waste [12].

The RA 9003 provides for creating Solid Waste Management Boards in LGUs, which will implement all programs relative to the reuse, recycling, and composting of solid waste. This law tasks the municipalities to prepare the 10-year solid waste management plan, implement waste characterization and segregation at source and provide separate containers for on-site collection with compostable, non-recyclable, and recyclable markings.

Moreover, RA 9003 expects the LGUs to reduce the amount of solid waste disposed of within five years through waste diversion activities and obligates them to provide a system for the collection and transport of solid wastes, establish a materials recovery facility (MRF) in every barangay or cluster of barangays, avoid waste generation, and strictly observe the 3Rs in the communities. The act also discourages the operation of open dumps or any waste disposal practice and requires the municipality to maintain a sanitary landfill five years after its effectivity. It also mandates the LGUs to provide incentive schemes for individuals, private organizations and entities, and non-government organizations to encourage the development of effective SWM projects, technologies, processes, and techniques that effectively manage solid waste [13–14].

Despite the presence of the law, solid waste generation keeps increasing, especially in urbanized areas. From 37,427.46 t d^{-1} in 2012, the country's estimated waste generation progressively increased to 40,087.45 t d^{-1} in 2016. With the current trend, World Bank estimates that the Philippines will produce 77,776 tons of solid waste per day in 2025, or an increase in the per capita generation of solid waste from the present 0.5 kg d^{-1} to 0.9 kg d^{-1}. [15] Nationwide, only 40–85% of waste is collected, which means that 15–60% is inappropriately disposed of or littered. Unfortunately, uncollected waste is either burned or dumped haphazardly in open areas known as open dumps [2] or mostly in bodies of water [15]. On the outskirts of Metro Manila, CALABARZON is a significant contributor to solid waste [16]. In 2016, CALABARZON generated 4,440.15 t d^{-1} of solid waste next to Metro Manila [15]. In 2018, the region produced 5694.90 t d^{-1} of solid waste [17]. Accordingly, SWM remains this region's most pressing problem for urbanizing towns [18] including its coastal municipalities.

According to Maske et al. [10], RA 9003 is a comprehensive policy that employs a holistic approach to addressing the worsening garbage problem. If enforced properly, it can significantly improve the country's SWM condition [19]. However, many law directives such as institutional oversight, foreclosure, and punishments are often overlooked in waste management [20]. Consequently, assessing the municipalities' compliance with RA 9003 becomes imperative to determine the provisions less adhered to in SWM implementation and identify the lapses that led to the current SWM situation.

Although there are many studies on solid waste in the Philippines, there still needs to be more literature regarding the municipalities' compliance with RA 9003. The majority of studies delved into the implementation of SWM practices [9, 21–24], local ordinances and institutional arrangements [25–26], and the objectives of the national policy [20, 27]. Other literature focused on the compliance of LGUs in terms of practices in waste handling [28] and 3R-based strategies in integrated solid waste management [29]. Meanwhile, research conducted in the CALABARZON analyzed the municipalities' compliance with RA 9003 by surveying municipal implementers of SWM [30] and focused on communities near the watershed [9]. A study has yet to be conducted on the compliance of coastal municipalities to RA 9003 through the assessments of officials, establishments, and residents, particularly in CALABARZON.

The constraints in implementing an SWM system vary depending on the town's location, such as hilly, coastal, or island [31]. The solutions to SWM problems must be localized and tailored to the local conditions and circumstances, for there is no one-plan-fits-all SWM solution that works for all local governments [32–33] due to the distinct characteristic of each city or municipality [33]. Planning and implementing an effective SWM necessitates the active involvement of the citizens and governments [34] because they have shared responsibility for waste management [35]. The development of exemplary SWM systems begins with assessment and planning so that the authorities and other stakeholders understand the current situation and decide on workable strategies to achieve their short-term and long-term SWM goals [36]. As espoused in the Theory of Good Governance [37], people should be allowed to participate in the government's decision-making process through dialogues and feed-back mechanisms. They should be allowed to render valuable inputs on how matters would be governed by engaging

them in the planning, development, implementation, and monitoring of programs, especially in areas that affect them and their environments.

Consequently, the purpose of this study is to assess the extent of compliance of Calaca to the RA 9003 in terms of institutional mechanism, comprehensive solid waste management, incentives, and financial solid waste management through the lenses of the local officials, establishments, and residents and determine the differences in their assessments. This paper is expected to bring to light the current condition of SWM in this coastal city and reveal the focal areas of noncompliance to RA 9003. It will also provide the local leaders with research-grounded data that can significantly help redirect their SWM initiatives and local policies toward improving their waste management system.

Materials and methods

1) Research locale

The City of Calaca is a coastal municipality in Batangas, one of the provinces in the CALABARZON region. It is bounded by Balayan Bay on the South. Topographically, it has ridges, substreams, barrancas, and highly dissected terrains, with the Balayan Bay as the catch basin [39] indicative of open spaces and bodies of water available for improper waste disposal. It has a total land area of 11,270.943 hectares divided into three ecosystems: coastal, which consists of 10 barangays and has a slope of 0–3%, lowland with 13 barangays and has a slope of 3–8% and upland consisting of 13 barangays and has a slope of 18–40%. The city is home to 81,859 people based on the 2015 PSA Census. Its most populous communities are situated in the coastal areas, which account for 37.28% of the population. [39] These areas are also the site of 13 major industries that provide employment locally and internationally, giving the municipality a steady migration rate of 14% [38].

Currently, Calaca is among the most progressive municipalities in the country. However, it needs to catch up to the schedule outlined in RA 9003. It closed its open dumpsite in 2018, which should have been closed in 2006 or five years after the implementation of RA 9003. SWM implementation became institutionalized in 2014 with the formulation of the 10-Year Solid Waste Management Plan (2014–2024) but still seeks approval from the National Solid Waste Management Commission (NSWMC) for the said plan (C. Balitustos, personal interview, 5th June 2019). There is also no exact data about the solid waste generated from the 40 barangays since waste collection covers only the six urban barangays since 2015 [38]. The garbage collection was reintroduced in the waste management system in early January 2020 providing services to 18 barangays situated along the highways, leaving waste management of the remaining 22 barangays in the hands of barangay leaders.

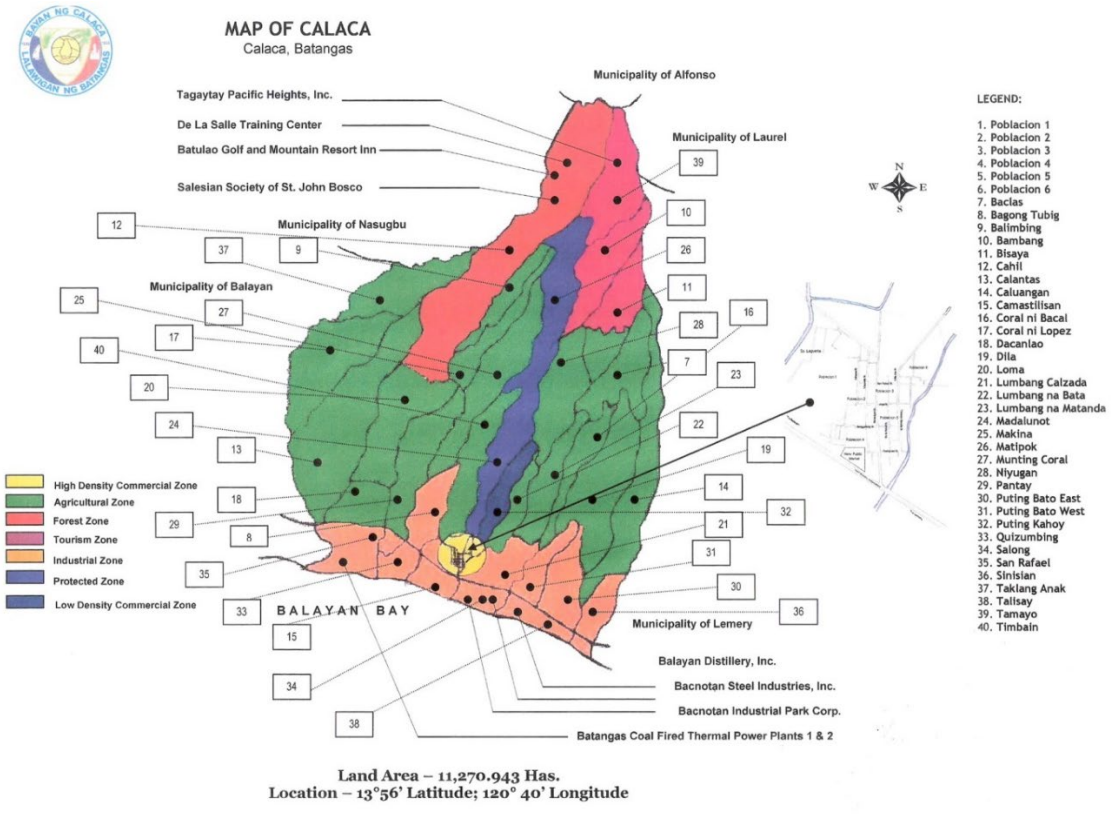

Figure 1 Map of Calaca showing the location of 40 barangays.

2) Methods

The study utilized a descriptive research design to provide a clear view of the SWM condition in Calaca. Five hundred ninety-four respondents were the target participants comprising 396 residents, 72 local officials, and 126 establishments. The study utilized a two-stage sampling in determining the sample population from the geographically dispersed population of 81,859, 902 business establishments and 320 local officials. In this method, the 40 barangays were first divided into three clusters based on their location in the ecosystems in Calaca, namely coastal, lowland and upland ecosystems. Then, the participant barangays for each cluster were chosen using random selection. The number of samples for each group of respondents in these barangays was determined using Slovin's formula. After determining the sample, the data were collected from the nine participant barangays using random sampling. These barangays included Dacanlao, Salong, and Camastilisan for the coastal; Pantay, Lumbang Matanda, and Bagong Tubig for the lowland; and Matipok, Tamayo, and Cahil for the upland. A researcher-made questionnaire was used to inquire into the extent of compliance of Calaca Municipality to RA 9003 in four areas: institutional mechanism, comprehensive solid waste management, incentive, and financing solid waste management. The indicators were based on RA 9003 and its implementing rules and regulations (IRR) and were scored using the rating scale and verbal interpretation (VI) below:

4 - Complied to a Great Extent (CGE) – 3.50 to 4.00
3 - Complied to a Moderate Extent (CME) – 2.50 to 3.49
2 - Complied to a Less Extent (CLE) – 1.50 to 2.49
1 – Complied to a Least Extent (CLEE) – 1.00 to 1.49

When all the information was gathered, frequency, weighted mean, standard deviation, ANOVA, and Scheffe's Test were used to treat quantitative data. Interviews and focus group discussion (FGD) were utilized to complement the relevant findings derived from the results.

Results and discussions

1) Extent of Compliance to RA 9003 or Ecological Solid Waste Management Act by Calaca Municipality

1.1) Institutional mechanism

The study assessed the extent of compliance of Calaca to institutional arrangements, set-ups, and SWM systems as provided in RA 9003. Table 1 shows that Calaca's compliance with the institutional mechanism has been to moderate extent, with an overall composite mean (OCM) of 2.55. In all indicators, the municipality was compliant in aspects dealing with consultation with the public, formulation of guidelines, crafting the SWM plan, and assigning key persons to monitor the SWM. However, the regular monitoring of SWM implementation at the component barangays and barangay monitoring of segregation of wastes were complied to a less extent with OCM of 2.50 and 2.35, respectively. Although the residents and establishments considered waste segregation monitoring less prioritized in municipal SWM, the latter assessed that Calaca has low compliance with the legal provisions on institutional mechanisms, with all items marked as complied to a less extent and an OCM of 2.37. The results indicated that they do not feel the presence of SWM programs and activities due to the lack of visibility of designated officials who strictly impose and monitor the policies.

This condition is a result of the institutional arrangement in Calaca. With the current set-up, no staff is hired to implement and monitor the SWM plans in the barangays while the number of SWM personnel in the LGU is insufficient to cater to the whole municipality. Calaca has only 35 personnel tasked to monitor the SWM implementation in the urban areas, while the rest is in the hands of the BSWMB. These include one designated Municipal Environment and Natural Resources Office (MENRO) officer, two mini dump truck drivers, one dump truck driver, six ECO Park personnel, five garbage collectors, nine market cleaners, and 11 sweepers [38]. According to Camarillo et al. [29] the lack of barangay environment authorities is a barrier to SWM implementation. [27] added that having political leadership and supportive institutional structures and framework are indispensable to the effective enforcement of RA 9003.

1.2) Comprehensive solid waste management (CSWM)

The compared evaluation of respondents on the RA 9003-based strategies/approaches employed by Calaca municipality in reducing and disposing of garbage is presented in Table 2.

Based on the results, the municipality's compliance with CSWM was low, as indicated by all items marked as complied to a less extent (OCM = 2.13). The assessment details showed that waste segregation at source, provision of appropriate trash bins, the establishment of SWM infrastructure and facilities, waste handling capability of waste collectors, and collection coverage and requirements are less complied according to the barangay officials, residents, and establishments. Therefore, these policies still need to be fully observed and implemented. Furthermore, waste collection coverage was the biggest concern because not all barangays have access to waste collection trucks (OCM = 1.85). The collected wastes are also not correctly segregated because

separate schedules for collecting specific types of waste were only complied with to a less extent (OCM =1.97). Based on the report of [38], since 2015, solid waste services have covered only the six urban barangays (Poblacion 1–6), and there was no waste collection for the remaining communities. Managing wastes was in the hands of the BSWMB. Considering that monitoring SWM in the component barangays is not strictly enforced, as indicated in Table 1, waste generators deal with their solid waste problem and dispose of their waste in their most convenient way. The findings were confirmed by the FGD participants who stated that the laws on solid waste management are not strictly and fully implemented in Calaca. The LGU is compliant only with cleanliness but is only 75–80 percent compliant with implemented policies like no burning. They also added that residents throw their solid wastes in ravines since there is no waste collection in lowland and upland barangays. This practice has negative implications since floods flow through these open spaces, carry the disposed waste and end up in Balayan Bay.

Table 1 Institutional mechanism

Items	Barangays officials		Residents		Establishments		Overall	
	WM	VI	WM	VI	WM	VI	WM	VI
The Municipal Solid Waste Management Board (MSWMB) regularly conducts consultations with the community regarding solid waste management programs/plans.	2.88	CME	2.74	CME	2.46	CLE	2.70	CME
The MSWMB develops specific guidelines and measures to be observed in the effective implementation of solid waste management.	2.84	CME	2.62	CME	2.45	CLE	2.61	CME
The barangay assigns core coordinators in implementing the solid waste management programs.	2.79	CME	2.58	CME	2.44	CLE	2.58	CME
The Barangay Solid Waste Management Board prepares the solid waste management program/plan in their jurisdiction.	2.93	CME	2.56	CME	2.36	CLE	2.57	CME
The MSWMB assists the barangays in their solid waste management.	2.77	CME	2.56	CME	2.41	CLE	2.55	CME
The MSWMB regularly monitors the effective implementation of solid waste management in its component barangays.	2.83	CME	2.50	CME	2.30	CLE	2.50	CLE
The barangay monitors the implementation of segregation and collection of wastes.	2.53	CME	2.37	CLE	2.17	CLE	2.35	CLE
Composite mean	2.80	CME	2.56	CME	2.37	CLE	2.55	CME

Table 2 Comprehensive solid waste management

Items	Barangays officials		Residents		Establishments		Overall	
	WM	VI	WM	VI	WM	WM	VI	WM
Wastes are mandatorily segregated at source.	2.47	CLE	2.41	CLE	2.35	CLE	2.41	CLE
Containers marked as compostable, non-recyclable, recyclable or special waste are provided to the residents.	2.36	CLE	2.34	CLE	2.09	CLE	2.29	CLE
The garbage collectors are trained in handling wastes to prevent spillage or scattering of solid wastes within the vicinity.	2.20	CLE	2.23	CLE	2.17	CLE	2.21	CLE

Table 2 Comprehensive Solid Waste Management (*continued*)

Items	Barangays officials		Residents		Establishments		Overall	
	WM	VI	WM	VI	WM	WM	VI	WM
The MRF in the barangay efficiently manages the final sorting, segregation, composting and recycling of the received wastes.	2.41	CLE	2.22	CLE	2.07	CLE	2.21	CLE
Composting of agricultural wastes and compostable materials is encouraged in the barangay.	2.24	CLE	2.20	CLE	2.03	CLE	2.17	CLE
The MRF or transfer stations are near the collection area and accessible to disposal facility for efficient handling of wastes.	2.29	CLE	2.07	CLE	2.07	CLE	2.10	CLE
The garbage collectors are equipped with personal protective equipment.	2.08	CLE	2.11	CLE	2.00	CLE	2.08	CLE
Collection vehicles have appropriate waste compartments for efficient storing of segregated wastes while in transit.	2.05	CLE	2.05	CLE	1.88	CLE	2.02	CLE
There are separate schedules for the collection of specific types of wastes.	2.01	CLE	1.98	CLE	1.93	CLE	1.97	CLE
Separate trucks are required for specific types of wastes which can access all barangays.	1.88	CLE	1.86	CLE	1.81	CLE	1.85	CLE
Composite mean	2.20	CLE	2.15	CLE	2.04	CLE	2.13	CLE

Consequently, there is a need for the municipality to improve its SWM systems by providing people access to solid waste services, capacitating collectors on waste handling, strictly enforcing waste segregation at the source, and providing an adequate number of trucks that comply with RA 9003. The topographical characteristics of the lowland and upland areas must also be considered in the SWM planning. Based on observation, some barangays are inaccessible to collection trucks due to their steep locations and unconstructed roads. Moreover, the LGU also has to revisit the functionality and operation of SWM facilities and infrastructure in the communities. Based on the interview results, MRFs in the barangays are small to accommodate the recyclable wastes from the community, for their sizes are comparable to dog houses. Participants also added that although a garbage truck collects solid wastes, they do not collect garbage from upland and lowland areas. The LGU has yet to have definite schedules for waste collection.

Studies proved that the lack of access to waste collection services, inadequate bins [40–41], non-operation of disposal facilities [9], and insufficient technical capacity to handle and dispose of wastes by SWM personnel [41] encourage improper waste practices among waste generators. Maintaining the quality, frequency, and regularity of waste collection [42] and widening the collection coverage by including the remote places in the provision [43] are needed to achieve good solid waste management at the community level. Also, the systematic management and supervision of the SWM activities, such as waste segregation, proper transporting, storing, treatment, and disposal of wastes, should be strictly observed at the barangay level [44].

1.3) Incentives

Table 3 shows that Calaca needs more compliance in providing rewards for the communities. Generally, the policies on rewarding barangays for hosting MRFs, using innovative programs in waste reduction and diversion, recycling initiatives, policy reforms, and CSWM technology development all complied to a lesser extent with an OCM of 2.27. Looking into the details, although barangay leaders agreed with residents and establishments that most policies were less enforced, they argued that implementing policy reforms on public participation (OCM=2.64), recycling projects (OCM=2.57), and CSWM prototypes/models (OCM= 2.68) were incentivized to a moderate extent. The assessments were in contrast to the views of residents and establishments who regarded them as complied to a less extent. Nevertheless, results indicated that Calaca has fewer reward schemes to encourage 3R-based solid waste management at the barangay level.

FGD participants confirmed that the town currently incentivizes only one ongoing solid waste project, the Plastic Mo, Ibote Mo (Put Your Plastic in a Bottle), which is a collaborative project between the LGU and Department of Social Welfare and Development (DSWD). The project involves 4Ps beneficiaries who represent a portion of the indigent population in the barangays. Therefore, the municipality has to be aggressive and creative in formulating programs and activities that will activate barangay involvement and participation in

SWM enforcement. Mobilizing the barangays will encourage broader public participation and increase stakeholders' awareness of the CSWM. [43–44] found that incentives influence people's perceptions and attitudes toward SWM and gear stakeholders to devise workable solutions to the garbage problem.

1.4) Financing solid waste management (FSWM)

The study focused on the LGU's utilization of government funding and budget concerning SWM, as shown in Table 4.

The extent of compliance by Calaca to FSWM is moderate, evidenced by the OCM of 2.51. However, only the activities related to information, education, communication, and monitoring of SWM implementation (OCM=2.69), technical assistance to barangays (OCM=2.55), and capability training (OCM=2.55) were moderately funded. Providing funds for establishing SWM infrastructure and facilities, conducting research, rewards/incentives, and utilizing technologies and processes that mitigate waste generation was complied with to a less extent. In addition, the establishments have assessed Calaca's compliance with FSWM policies to a less extent, with an OCM of 2.29.

Table 3 Incentives

Items	Barangays officials		Residents		Establishments		Overall	
	WM	VI	WM	VI	WM	WM	VI	WM
Barangays that initiated policy reforms on solid waste management such as community participation in co-management are given incentives by the municipality.	2.64	CME	2.49	CLE	2.13	CLE	2.43	CLE
The municipality incentivizes barangays with effective recycling projects.	2.57	CME	2.34	CLE	2.03	CLE	2.31	CLE
The municipality grants incentives to persons or groups with comprehensive Solid Waste Management Models/ Prototypes which cover sustainable development requisites.	2.68	CME	2.31	CLE	2.08	CLE	2.31	CLE
The municipality rewards barangays that host solid waste management facilities (i.e. Material Recovery Facilities).	2.37	CLE	2.33	CLE	2.00	CLE	2.26	CLE
The municipality provides rewards, monetary or otherwise for innovative projects, technologies, and processes in the re-use, recycling and reduction of wastes.	2.45	CLE	2.29	CLE	1.98	CLE	2.25	CLE
The municipality gives incentives to barangays with innovative strategies that reduce wastes.	2.48	CLE	2.22	CLE	1.96	CLE	2.20	CLE
Incentives are provided to barangays that use alternative indigenous processes, materials, technologies and approaches in recycling/re-using wastes.	2.45	CLE	2.20	CLE	1.87	CLE	2.16	CLE
Composite mean	2.52	CME	2.31	CLE	2.01	CLE	2.27	CLE

Table 4 Financing solid waste management

Items	Barangays officials		Residents		Establishments		Overall	
	WM	VI	WM	VI	WM	WM	VI	WM
The municipality is spending for information, education, communication and monitoring activities related to solid waste management.	2.92	CME	2.72	CME	2.47	CLE	2.69	CME
The municipality provides technical assistance (coaching) to barangays in addressing problem areas in solid waste management.	2.88	CME	2.54	CME	2.36	CLE	2.55	CME
The municipality conducts capability building activities in communities related to solid waste management.	2.77	CME	2.55	CME	2.23	CLE	2.51	CME
The municipality encourages research on solid waste management to be funded by them.	2.72	CME	2.46	CLE	2.29	CLE	2.46	CLE
The municipality encourages the participation of the public in solid waste management through its awards and incentives scheme.	2.59	CME	2.51	CME	2.24	CLE	2.46	CLE
The municipality funds the cost of preparing, adopting and implementing solid waste management plan based on the types of solid waste, mount/volume of wastes and distance of the MRF to the waste management facility.	2.57	CME	2.51	CME	2.20	CLE	2.45	CLE
The municipality financially supports products, facilities, technologies and processes to enhance solid waste management.	2.56	CME	2.46	CLE	2.24	CLE	2.43	CLE
Composite mean	2.72	CME	2.54	CME	2.29	CLE	2.51	CME

These results can be linked with the status of CSWM policy enforcement in Table 2. The funds allotted for SWM initiatives and programs are insufficient to carry out all activities required under the Act, such as supporting the costs of infrastructure and facilities, conducting information and dissemination campaigns and training, hiring and capacitating SWM personnel, purchasing the needed technologies and equipment and providing broader collection coverage for the municipality. Interviews with key informants revealed that although the barangays always allot a sizeable amount for SWM activities, the budget comes solely from the LGU. The municipality has not received any budget from the national government because of the absence of its 10-Year SWM plan. Consequently, there is a need for Calaca to tap into the national budget to have more considerable financial resources by securing the approval of its SWM Plan. The plan is necessary in availing the national fund and giving direction to Calaca on its SWM implementation.

Sumalde [45] found that implementing SWM is very costly for LGUs. Lack of financial resources affects the municipality's ability to manage waste effectively [41,46]. The LGUs need the financial support they require for the complete and satisfying delivery of the service of the government in their action toward SWM [6].

2) Comparison of Assessments on the Extent of Compliance to RA 9003

Table 5 revealed that differences in the assessments of barangay officials, residents, and establishments in terms of institutional mechanism (F-value=7.21; p-value<0.001), incentives (F-value=10.66; p-value< 0.01), and FSWM (F-value=8.00; p-value<0.001) were significant while no significant difference was found in terms of CSWM (F-value=1.19; p-value=0.31). Further analysis showed that the establishments' assessment differed significantly from the barangay officials (Mean diff=0.425; p<0.01), (Mean diff=0.426; p<0.01) and residents (Mean diff=0.514; p<0.01), (Mean diff=0.246; p<0.01) in terms of institutional mechanism and FSWM, respectively while their evaluations have differed from barangay officials (Mean diff=0.303; p<0.01) regarding incentives.

Table 5 Compared assessments on the extent of compliance to RA 9003

	ANOVA			Scheffe's Test			
	F-value	**P-value**	**Significance**	**Group pair**	**Mean diff.**	**P-value**	**Significance**
Institutional mechanism	7.21	< 0.001	Highly Significant	Barangays officials vs. establishments	0.425	< 0.01	Highly Significant
				Residents vs. establishments	0.514	< 0.01	Highly Significant
Comprehensive solid waste management	1.19	0.31	Not Significant				
Incentives	10.66	< 0.01	Highly Significant	Barangays officials vs. Establishments	0.303	< 0.01	Highly Significant
Financing solid waste management	8.00	< 0.01	Highly Significant	Barangays officials vs. establishments	0.426	< 0.01	Highly Significant
				Residents vs. establishments	0.246	< 0.01	Highly Significant

The barangay officials, being the implementers of SWM policies, are considered knowledgeable of the institutional arrangements and structures as well as the budget of the community because they are the promoters of programs and initiatives. Hence, they know Calaca's legal and institutional framework and fiscal status. This influences their belief that they have sufficiently fulfilled their obligations in public service, despite the relatively modest number of SWM initiatives they have implemented. Findings of Jeremias et al. [47] affirmed that barangay officials are the primary source of in-formation regarding SWM since they are very familiar with the policies and initiatives cascaded from the LGU. They also formulate resolutions tailored to local conditions and enforce them, which instills in them a sense of ownership of the SWM process. Meanwhile, the households have a better grasp of the institutional frameworks and budget since most of them stay home and receive relevant information about the government through consultation meetings and seminars. Based on observation, their residences are near the center where most government activities are held. In contrast, most establishments are located near the highways and central business districts, usually far from the barangay's halls. Their level of awareness about SWM is influenced by the frequency of their transactions with the government.

Consequently, the municipality needs to intensify information dissemination and educational campaigns on SWM systems and institutional arrangements. More SWM activities must be organized as they reflect budget utilization. Similarly, Guerrero et al. [35] found that awareness campaigns develop concerns for the environment among individuals and compel them to engage in the implementation of solutions.

Regarding compliance with CSWM, results showed that all respondents have the same experiences regarding ineffective SWM. They generate waste daily and experience waste disposal challenges. Thus, there is a need to address the barriers to the effective implementation of solid waste management. These include a lack of political will of government officials, limited assistance to LGUs, improper waste disposal, low compliance to the utilization of MRF, and low compliance with final disposal facilities [2]. With regards to incentives, as partakers in SWM implementation, the barangay officials believed that they had provided enough incentives for SWM activities. On the other hand, the establishments expect more from the government as they are the receivers of waste services. Similar to the results in Table 1, they feel the SWM systems in the municipality is absent, which includes the incentives.

Conclusions

Despite the mandate to adopt RA 9003, Calaca has not fully complied with the law. Implementing SWM policies in the component barangays and waste segregation is not strictly monitored; waste collection remains a significant concern, and enforcement of waste segregation, provision of appropriate bins, technical capacity of waste handlers, and utilization of MRFs are lacking. Moreover, reward schemes are fewer, while insufficient funds affect the delivery of solid waste services. The assessments of the officials, residents, and establishments regarding Calaca's compliance with institutional mechanisms, FSWM, and incentives significantly differed despite their agreement regarding CSWM, indicating a low level of awareness among stakeholders and a weak SWM system.

Thus, the municipality must demonstrate tenacity and firm resolve in complying with all the fundamental provisions of RA 9003. Restructuring its SWM system to include enforcers who will monitor SWM and impose incentives, penalties, and fines, particularly in areas prone to improper disposal, will strengthen SWM implementation. The national government should also closely monitor the performance of both the BSWMB and MSWMB to ensure high compliance with CSWM policies at the community level. To address waste collection challenges, involving the informal sector is also a potential alternative for servicing inaccessible barangays. Intensified information education campaigns should also be undertaken to enhance the stakeholders' level of education on SWM and instill a sense of co-ownership of the SWM programs.

Moreover, technical assistance should be provided to the LGU to ensure the approval of its 10-year SWM plan. With the approved plan, Calaca will have more financial resources by tapping the national fund to support its SWM program, establish a more robust SWM system and provide more comprehensive waste collection services for its people. Consultative meetings with the community, business establishments, educational institutions, and other stakeholders on areas of non-compliance to RA 9003 are imperative to tailor a more comprehensive and sustainable SWM plan for Calaca.

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