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The Environmental and Urban Planning International Journal (EUPIJ) is published quarterly, meaning four issues are released each year. This schedule allows for regular sharing of research findings and developments, while providing enough time for peer review and editorial work. By publishing quarterly, the journal ensures a balance between timely updates and high-quality content.

Each issue covers a range of topics, offering valuable research that is both relevant and impactful. The quarterly schedule also gives authors time to improve their work based on feedback, maintaining the journal's credibility and integrity. This process helps ensure that the journal remains a trusted source of knowledge in the field of environmental and urban planning. Additionally, it provides opportunities for collaboration and engagement among researchers, fostering a dynamic academic community.

The regular publication cycle also facilitates the inclusion of emerging topics and timely issues that are critical for both academic study and real-world application. It keeps the academic community informed on the latest trends, challenges, and innovations in environmental and urban planning, while supporting ongoing scholarly growth. Furthermore, the journal's consistent publishing schedule encourages authors to contribute regularly, creating a stable flow of research that continues to shape the discourse in the field.

Overall, this publication approach helps the EUPIJ maintain its position as a leading journal in environmental and urban planning, contributing to the advancement of knowledge, policy development, and practical solutions for sustainable urban development. The journal’s ongoing commitment to high standards ensures its relevance and utility for academics, practitioners, and policymakers alike.

ABOUT THE PUBLISHER

The Environmental and Urban Planning International Journal (EUPIJ) reflects the institution's commitment to fostering environmental and urban planning disciplinary research and facilitating academic exchange. As a respected publication, it provides a platform for scholars, researchers, and professionals from various fields to share their findings, insights, and innovations. Published by Zas Digital Institute Training and Development Services (DITADS), the journal focuses on the dissemination of high-quality research spanning a specific array of disciplines, including but not limited to environmental sciences, natural sciences, aquatic sciences, and other related fields.

The journal serves as a vital resource for advancing knowledge and facilitating dialogue among researchers, practitioners, and policymakers. By embracing interdisciplinary research, EUPIJ aims to address the complex issues of today's global society. It seeks to provide well-rounded solutions and perspectives by integrating ideas from various sectors of knowledge, enabling more holistic approaches to solving contemporary challenges.

Through its rigorous peer-blind review process and commitment to academic excellence, the Environmental and Urban Planning International Journal aims to contribute significantly to the global research community. The journal offers valuable insights into contemporary challenges and solutions, pushing the boundaries of academic inquiry in its focus areas. By providing a forum for the exchange of diverse ideas and research, it continues to promote innovation, foster intellectual growth, and inspire new thinking across disciplines.

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With its well-established credentials and adherence to national and international standards, EUPIJ stands as a cornerstone for academic excellence, bridging diverse fields of study and facilitating a global exchange of knowledge and ideas.

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RATIONALE

The Environmental and Urban Planning International Journal (EUPIJ) was established to serve as a dynamic platform for the exchange of knowledge and ideas from the fields of environmental and urban planning. With the growing need for research in environmental and urban planning that addresses complex global challenges, this journal aims to foster collaboration among scholars, researchers, and professionals from diverse academic backgrounds. By providing a space for high-quality research in fields such as environmental sciences, natural sciences, aquatic sciences, technology, and urban development, EUPIJ contributes to the development of solutions that are both innovative and comprehensive.

The journal's primary goal is to enhance academic discourse and promote the dissemination of cutting-edge research, offering valuable insights that can inform policy, improve practices, and inspire future studies. By covering a wide range of topics, from urban planning development to environmental issues, the journal reflects the diverse and interconnected nature of today's environmental and sustainability landscape. Its intra- and interdisciplinary approach allows for the examination of issues from different angles, helping to create more robust and holistic solutions that address urgent global challenges, such as climate change, urbanization, and resource management.

EUPIJ also plays a crucial role in advancing the academic community by providing a platform for emerging voices and encouraging scholarly engagement across borders. Through its rigorous peer-blind review process, the journal ensures that only well-researched, impactful, and scientifically rigorous articles are published, maintaining its academic integrity and reputation. This process not only supports researchers but also engages a broader audience, including policymakers and practitioners, by bridging the gap between academic research and real-world application. It also allows the journal to maintain a diverse pool of contributors, ensuring that the content is reflective of a global and multi-perspective view on environmental and urban planning issues.

In line with the vision of Zas Digital Institute Training and Development Services (DITADS), EUPIJ aims to contribute significantly to both local and global research communities. It is committed to promoting academic excellence and fostering a deeper understanding of contemporary issues that affect societies worldwide. As part of its mission, the journal encourages collaboration between academic institutions, government bodies, private sectors, and non-governmental organizations, ensuring a comprehensive and inclusive approach to solving environmental and urban planning challenges.

This journal represents a vital tool for the ongoing development of knowledge and innovation, making it an indispensable resource for researchers, academics, and professionals who are committed to making a positive impact on society. EUPIJ is not only an academic publication but a catalyst for action, driving change through research that empowers communities and fosters sustainable development across the globe.

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The Effect of Installed Trash Traps within the Province of Cavite Under the MBRP for Years 2021-2023: A Baseline Study

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ABSTRACT

The uncontrolled generation of solid waste that drains through the waterways of the Province of Cavite into Manila Bay poses a serious environmental threat to the bay's natural environment and biodiversity. In response to the Supreme Court's Writ of Continuing Mandamus under G.R. No. 171947-48, the Department of Environment and Natural Resources – Provincial Environment and Natural Resources Office (DENR–PENRO) Cavite, through the Manila Bay Site Coordinating/Management Office (MBSCMO) Cavite, installed 49 trash traps strategically positioned along the six major river systems of the province as part of the Manila Bay Rehabilitation Program (MBRP). This baseline study employed a mixed-methods research design using the nested (embedded) approach, with data analyzed through the percentage method. Monitoring was conducted over three years (2021–2023). Results revealed that, on average, 66% of installed units were functional while 34% were non-functional across the monitoring period. Despite this, the installed units collectively captured a total of 2,037,227 kilograms (approximately 2,005.1 metric tons) of mixed solid wastes. Waste collection increased by 72% from 2021 to 2022 (669,091 kg to 928,754 kg), partly attributed to COVID-19-related healthcare waste. A notable decrease of -211% was recorded in 2023 (as of the 3rd quarter), reflecting positive outcomes from intensified Communication, Education and Public Awareness (CEPA) campaigns, establishment of barangay ecological gardens, and other solid waste management interventions. The study concludes that trash traps are effective solid waste interception mechanisms and recommends their turnover to respective Local Government Units (LGUs) through a Memorandum of Agreement (MOA) and the replication of the project in applicable waterways.

Keywords: *Trash Traps, Manila Bay Rehabilitation Program, Solid Waste Management, DENR–PENRO Cavite, Waterway Pollution, River Rangers, MBRP, Environmental Baseline Study*

BACKGROUND OF THE STUDY

A. History of the Department of Environment and Natural Resources (DENR)

The history of DENR started during the Spanish colonization in the Philippines. It was in 1863 when the *Inspección General de Montes* in the Philippines was created by virtue of a Spanish Royal Decree with functions and responsibilities that included several concerns related to the management of a wide range of natural resources, such as forest inventory and protection, water, biodiversity, and mineral resources conservation. The *Departamento de Formento,* or the Department of Public Welfare, was established in 1898 by a decree signed by Gen. Emilio Aguinaldo, where one of its divisions was the Industry and Agricultural Division, and one of its sections was the Mines and Mountains Section.

The Americans came and reorganized the government, resulting in the creation of the Department of the Interior in 1901, which was vested with powers and authority on matters that included natural resources. In 1916, the Philippine Government issued Act No. 2666, "An Act to Reorganize the Executive Department of the Government of the Philippine Islands", transferring the functions and authority regarding agriculture and natural resources from the Department of Interior to the Department of Agriculture and Natural Resources

(DANR). The bureaus under its supervision include Agriculture, Forestry, Lands, Science, and Water.

The shift to the parliamentary form of government led to the renaming of the DNR to the Ministry of Natural Resources (MNR) in 1978. Subsequently, Executive Order (EO) No. 131 was issued on January 30, 1987, creating the Department of Energy, Environment, and Natural Resources (DEENR), taking the powers and functions of the MNR. It also incorporated the emerging critical concerns about energy and the environment. However, the said EO was not implemented. Thereafter, the government issued EO No. 192 on June 10, 1987, reorganizing the DEENR and renaming it as the Department of Environment and Natural Resources (DENR) while transferring energy matters to the Office of the President. The bureaucracy is decentralized with the transformation of former line bureaus to staff bureaus, and most of the line functions are transferred to the regional and field offices. The sectoral staff bureaus of the DENR are as follows:

a. Forest Management Bureau (FMB)–integrating and absorbing most of the powers and functions of the Bureau of Forest Development and the Wood Industry Development Authority.
b. The Land Management Bureau (LMB) is the central office of the Bureau of Lands, integrating the district land offices with the DENR field offices.
c. Mines and Geosciences Bureau (MGB)–absorbing the functions of the Bureau of Mines and Geosciences.
d. Environmental Management Bureau (EMB)–integrating the National Environmental Protection Council (NEPC), National Pollution Control Commission (NPCC), and the Environmental Center of the Philippines (ECP).
e. Ecosystems Research and Development Bureau (ERDB) is a merger of the former Forest Research Institute and the National Mangrove Committee.
f. Protected Areas and Wildlife Bureau (PAWB)

The enactment of RA 7942, otherwise known as the Philippine Mining Act, in 1995 restored the line functions of the MGB and provided for the creation of its regional offices nationwide.

Similarly, the enactment of RA 8749, otherwise known as the Philippine Clean Air Act, transformed the EMB from a staff bureau to a line bureau and mandated it to be the lead agency in the overall implementation of the law's provisions. Likewise, the Pasig River Rehabilitation Commission (PRRC) was created by virtue of EO 54 and attached to the DENR in the same year through EO 65.

On October 18, 2013, the Department of Budget and Management (DBM) approved the DENR Rationalization Plan (RatPlan). Through the said RatPlan, the DENR was able to focus on the vital and core functions of the agency, improve the quality and efficiency of services by eliminating overlaps and duplications of functions, and promote efficient and result-oriented performance and accountability. The PAWB was also renamed as the Biodiversity Management Bureau (BMB) to represent the expanding responsibilities beyond protected areas.

B. DENR Mandate, Vision, and Mission DENR Mandate (EO 192, s. 1997)

The Department is the primary government agency responsible for the conservation, management, development, and proper use of the country's environment and natural resources, specifically forest and grazing lands, mineral resources, including those in reservations and watershed areas, and lands of the public domain, as well as the licensing and regulation of all natural resources, as may be provided for by law, for equitable sharing of the benefits derived therefrom for the welfare of the present and future generations of Filipinos.

To accomplish this mandate, the Department shall be guided by the following objectives, to wit:

a. Assure the availability and sustainability of the country's natural resources through judicious use and systematic restoration or replacement, whenever possible;
b. Increase the productivity of natural resources in order to meet the demands for forest, mineral, and land resources of a growing population;
c. Enhance the contribution of natural resources for achieving national economic and social development;
d. Promote equitable access to natural resources by the different sectors of the population; and,
e. Conserve specific terrestrial and marine areas representative of the Philippine natural and cultural heritage for present and future generations.

DENR Vision. A nation enjoying and sustaining its natural resources and a clean and healthy environment.

DENR Mission. To mobilize our citizenry in protecting, conserving, and managing the

environment and natural resources for the present and future generations.

Development Goal. Human well-being, environmental quality, and sustainability are ensured.

Organizational Outcomes

- Promote human well-being and ensure environmental quality
- Sustainably-managed environment and natural resources
- Adaptive capacities of human communities and natural systems ensured

DENR Five (5)-point Agenda. The DENR thrust and priorities are anchored on a five (5)-point agenda, to wit:

1. Poverty reduction and hunger mitigation
2. Socio-economic development
3. Natural resources conservation
4. Climate change mitigation and adaptation measures
5. Environmental education and enforcement

DENR Ten (10) Priority Programs. The Ten (10) Priority Programs of the agency are as follows:

1. Clean Air
2. Clean Water
3. Solid Waste Management
4. Geo-hazard, Groundwater Assessment, and Responsible Mining
5. Forest and Watershed Management
6. Intensified Forest Protection and Anti-illegal Logging
7. Enhanced Biodiversity Conservation
8. Scaling up of Coastal and Marine Ecosystem
9. Improved Land Administration and Management
10. Manila Bay Clean-up

Similarly, the different development frameworks such as Sustainable Development Goals under the United Nations, Philippine Long-Term Vision–Ambisyon Natin 2040, Philippine Development Plan 2017-2022, and the Program for Environment and Natural Resources for Restoration, Rehabilitation and Development (PRRD) are bases of aforementioned programs implementation towards "*MATATAG, MAGINHAWA AT PANATAG NA BUHAY*."

C. Organizational Structure

The Department is headed by the Secretary and is being assisted by nine (9) Undersecretaries and eight (8) Assistant Secretaries. Under them are four (4) staff bureaus (FMB, LMB, BMB, and ERDB), two (2) line bureaus (EMB and MGB), 16 Regional Environment and Natural Resources Offices, 76 Provincial Environment and Natural Resources Offices (PENROs), and 143 Community Environment and Natural Resources Office (CENROs).

D. DENR CALABARZON and its Organizational Structure

DENR Region IV–A, also known as the CALABARZON Region, was created on May 17, 2002, by virtue of EO 103. It is located in the southwestern part of Luzon, just south and east of Metro Manila, on the east by the Philippine Sea and Bicol Region, on the south by Verde Island Passage, and on the west by Luzon Sea. It is practically accessible via all types of land transportation.

The DENR CALABARZON Region is headed by the Regional Executive Director, with five (5) PENROs and seven (7) CENROs.

E. PENRO Cavite Profile and its Organizational Structure

The Provincial Environment and Natural Resources Office (PENRO) plans, coordinates, controls, prepares and updates plans for the protection of the environment, development and conservation of natural resources in the provinces; enforces environment and natural resources laws, rules and regulations; and performs such functions that may be assigned by higher authority.

The two (2) divisions at the PENRO Cavite Level are as follows:

a. Technical Services Division – coordinates and supervises the implementation of all policies, regulations, programs and projects on environmental and natural resources conservation in the province; supervises the provision of technical services to the CENROs within its jurisdiction; represents the province in the provincial development bodies in the formulation and implementation of provincial plans and programs; and performs such functions that may be assigned by higher authority. It is composed of three (3) sections, namely the Conservation and Development Section, the Regulation and Permitting Section, and the Monitoring and Enforcement Section.

b. Management Services Division – oversees the delivery of financial and administrative services within its jurisdiction; ensures that all

administrative and financial transactions are in compliance with COA, DBM and CSC rules and regulations; ascertains that plans and programs are attained through sufficient and timely release of funds; monitors spending vis-a-vis accomplishments for efficient and economic fund utilization within its jurisdiction; provides assistance and services on the implementation of office orders, rules and regulations on matters involving personnel management, general services, communications, logistics, property, safety, records management and documentation; and performs other functions that may be assigned by higher authority. It shall be composed of two (2) sections, namely the Planning and Management Section and the Administrative and Finance Section.

However, PENRO Cavite is an implementing PENRO or one of those PENROs without CENRO(s), which perform the roles and functions of a CENRO. Hence, in addition to its supervisory function, the said Office is also responsible for the implementation of all laws, policies, regulations, programs, and projects, rules and regulations on the management, conservation, development, and use of natural resources.

F. The Manila Bay Rehabilitation Program (MBRP) and the Manila Bay Region

On December 18, 2008, the Supreme Court issued a decision under G.R. No. 171947-48 ordering the 13 Mandamus Agencies to clean up, rehabilitate, and preserve Manila Bay in their own capacities. Moreover, the water quality of the Manila Bay should be restored to Class B Sea Waters, which are fit for swimming, skin-diving, and other forms of contact recreation as per the Water Classification Table under the DENR Administrative Order No. 34 s. 1990.

The DENR, as the lead agency, together with the 13 Mandamus Agencies namely DENR, Department of Interior and Local Government (DILG), Department of Education (DepEd), Department of Health (DOH), Department of Agriculture (DA), Department of Public Works and Highways (DPWH), DBM, Philippine Coast Guard (PCG), Philippine National Police-Maritime Group (PNP-MG), Philippine Port Authority (PPA), Metropolitan Manila Development Authority (MMDA), Metropolitan Waterworks and Sewerage System (MWSS), and Local Water Utilities Administration (LWUA) are mandated to implement the Operational Plan for the Manila Bay Coastal Strategy (OPMBCS) which focuses on five (5) areas of concerns such as liquid waste management, solid waste management, informal settlers, habitat and resource management and institutional arrangement/partnership governance. The integration of land use governance frameworks and smart technologies into environmental planning efforts remains a critical complement to programmatic interventions such as the MBRP, particularly in ensuring that rehabilitation outcomes are sustainable and institutionally anchored (Santiago, 2025a).

The said decision was further strengthened by virtue of a Supreme Court En Banc resolution dated February 11, 2011, through the creation of the Manila Bay Coordinating Office (MBCO) under the DENR Administrative Order No. 2011-01. The MBCO was directed to fully implement the OPMBCS in coordination with the mandamus and other cooperating agencies. Likewise, the DAO designated the DENR Regional Executive Directors (RED) of Regions III, CALABARZON, and National Capital Region (NCR), who have jurisdiction over the Manila Bay, as Regional Coordinators and Heads of their own reconstituted Manila Bay Site Coordinating/Management Office (MBSCMO).

On February 19, 2019, President Rodrigo R. Duterte issued Administrative Order No. 16, "Expediting the Rehabilitation and Restoration of the Coastal and Marine Ecosystem of the Manila Bay and Creating the Manila Bay Task Force". The Task Force members shall perform their functions in accordance with their agency mandates and as prescribed in the Writ of Continuing Mandamus.

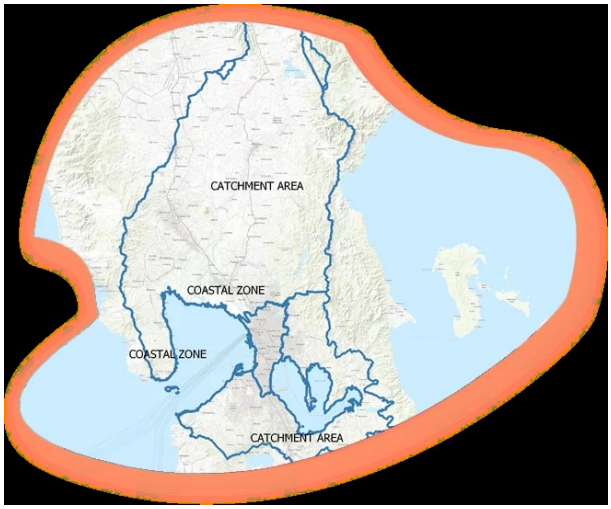
The Phases of Manila Bay Rehabilitation are as follows, to wit:

a. Phase 1 – Clean-up/Water Quality Improvement
b. Phase 2 – Rehabilitation and Resettlement
c. Phase 3 – Education and Sustainment

Aside from being a historical symbol for the Filipino people, Manila Bay is a marine gem that unceasingly makes a significant economic contribution to the country. It is located in the southwest portion of Luzon, facing the West Philippine Sea. Its surface area measures around 199 square kilometers (199,400 hectares), covering eight (8) provinces, 178 Local Government Units (LGUs), and 5,714 barangays in Regions III (Central Luzon), CALABARZON, and NCR (see Figure 1). The Bay has a 190-kilometer stretch of coastline, with at least 17 major river systems in the three regions draining into it.

G. The Manila Bay Site Coordinating/Management Office (MBSCMO) Cavite and its Organizational Structure

The DENR – PENRO Cavite thru the MBSCMO Cavite is implementing the MBRP to clean-up and rehabilitate the six (6) major river systems in the province namely Zapote, Imus, Ylang-Ylang-Rio Grande, Canas, Labac and Maragondon, to include coastal areas, waterways and canals/esteros within the Province of Cavite that are draining directly to Manila Bay (see Figure 2).



Source: Manila Bay Coordinating Office (manilabayanihan.com)

Figure 1. The Manila Bay Region.

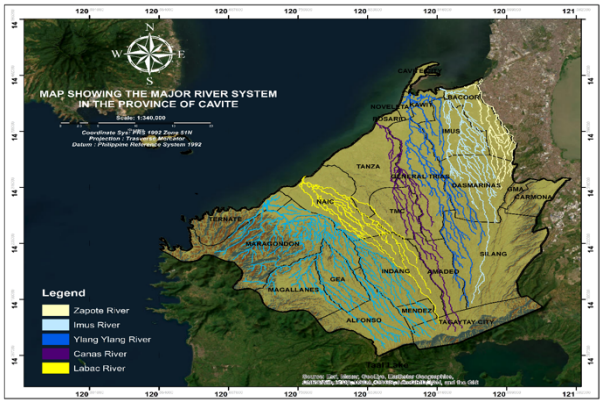


Figure 2. The Six (6) Major River Systems in the Province of Cavite.

The following are the five (5) target outcomes per cluster of the OPMBCS that are being interpreted into different activities of the MBSCMO Cavite to be able to appreciate the correlation of establishing an activity to one another in achieving the goal of cleaning up, rehabilitating, and preserving the Manila Bay, to wit:

a. Liquid Waste Management–The liquid wastes discharging into Manila Bay are compliant with the General Effluent Standard (GES) and/or the ambient water quality with the water quality guidelines.
b. Solid Waste Management–The amount of solid waste ending up in Manila Bay is reduced.
c. Informal Settler Families (ISFs) and Illegal Structures – Houses, structures, constructions, and other encroachments along easement areas in rivers/waterways, esteros, lakes, bays, and coastlines within the Manila Bay Region are permanently removed.
d. Habitat and Resource Management–The existing biodiversity within the Manila Bay Region is safeguarded and preserved, and soil loss in the bay is reduced.
e. Institutional Arrangement/ Partnership and Governance–The OPMBCS is properly implemented, entrusting the Mandamus Agencies and the MBSCMO to collaborate/converge in order to achieve its Key Performance Indicators (KPI).

Relative to the aforesaid five (5) target outcomes of the OPMBCS, various interventions are being undertaken by the MBSCMO Cavite in order to clean up, rehabilitate, and preserve Manila Bay, such as but not limited to the following:

a. installation of Aquatic Macrophyte Biosorption System (AMBS)
b. installation of a biogas digester
c. clean-up activities/solid waste collection through River Rangers, trash traps/trash nets, and donated trash boats
d. fabrication and installation of trash traps/trash nets
e. establishment of barangay ecological gardens and establishment of composting facilities
f. ground delineation of easement area and inventory of Informal Settler Families (ISFs)
g. hiring of River Rangers (RRs)

With all these interventions, improper solid waste management in the Province of Cavite can still be observed. This dilemma can be very alarming because mixed solid wastes are found in some of the rivers/waterways/canals that drain into Manila Bay. In addition to this, Cavite has no sanitary landfill (SLF) that will cater to all the generated solid wastes of the province. Thus, in view of the goal to reduce solid wastes ending up in Manila Bay, there are forty-nine (49) installed trash traps within the Province of Cavite (see Figure 3). It is an intervention under the Solid Waste Management Cluster of the MBRP that aids in the screening of solid waste along waterways and makes their collection easier.

The former DENR Secretary Roy A. Cimutu called this endeavor the "Battle for Manila Bay" and he added that "This is one battle that will be won not with force or arms, but with the firm resolve to bring Manila Bay back to life." Consequently, the MBSCMO Cavite is composed of committed and determined individuals/employees who are willing to do his/her share in these rehabilitation efforts, and is headed by a Focal Person.

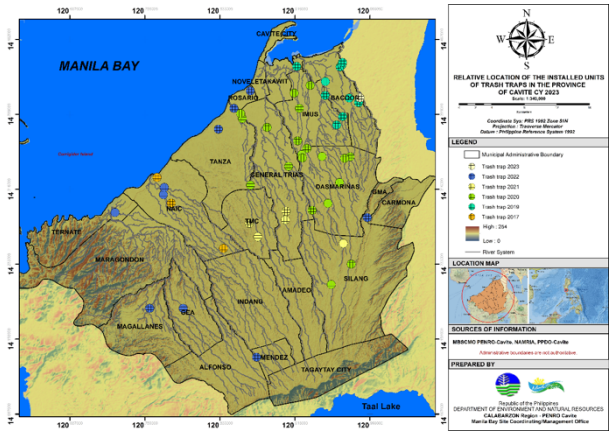


Figure 3. The 49 Installed Trash Traps within the Province of Cavite.

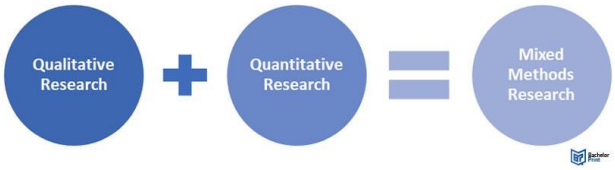
STATEMENT OF THE PROBLEM

The uncontrolled solid waste generation ending up in the waterways of the Province of Cavite, draining into Manila Bay, is a serious environmental problem that threatens the natural environment as well as the biodiversity in the Manila Bay Region.

MATERIALS AND METHODS

Research methodology refers to specific procedures for collecting and analyzing data that guarantee substantial and reliable findings that address the research problem.

In this study, the researchers used mixed-method research. It is a research approach where researchers collect and analyze both qualitative and quantitative data within the same study (see Figure 4). It draws on potential strengths of both qualitative and quantitative methods, which allow researchers to explore diverse perspectives. Moreover, this approach supports the articulation of different techniques to deepen the study of a given phenomenon in a broader and deeper perspective, in order to obtain richer and more varied data that might be drawn from several approaches or paradigms.



Source: Mixed Methods Research ~ Different Types & Examples (bachelorprint.com)
Figure 4. The Mixed Method Research.

Due to time restrictions and/or scarce resources, the researchers adopted the nested research design of the Mixed Method Research. This approach is also known as the embedded method where both qualitative and quantitative data are collected concurrently. However, one type of data takes precedence over the other.

To further analyze and process the collected data, the researcher used the Percentage Approach, the most commonly used statistics. It is a relative value indicating hundredth parts of any quantity. Besides being especially useful when making comparisons, they come in handy for studying a difference compared with a benchmark or initial value. Figure 5 shows the Percentage Formula as follows:

$$\text{Value 1 as a percentage of Value 2} = \frac{\text{Value 1}}{\text{Value 2}} \times 100\%$$

Source: Percentages Concepts and Definitions (mom.gov.sg)
Figure 5. The Percentage Formula.

RESULTS AND DISCUSSION

The Installed Trash Traps within the Province of Cavite

One of the identified serious environmental problems that threatens the natural environment as well as the biodiversity in the Manila Bay Region is the uncontrolled solid waste generation, ending up in the waterways of the Province of Cavite. As a response, one of the strategies/interventions undertaken by the MBSCMO Cavite is the installation of trash traps in strategic locations within the waterways of the province. The installed units will be able to trap/screen the solid wastes before reaching the Manila Bay. Hence, it will improve the waste collection and proper disposal which help reduce flooding during the rainy season.

Prior to installation, coordination meetings between the concerned LGU and the MBSCMO Technical Personnel will be conducted in order to identify possible locations where trash trap is deemed necessary. Nevertheless, trash traps are only applicable in river/tributary/waterbody with a width

of 20 meters and below. Once the LGU has approved the location, PENRO Cavite will facilitate the procurement process and the trash trap design to be used is drawn/designed by the licensed Civil Engineer of the MBSCMO 4 – CALABARZON. The participatory dimension of this coordination process reflects broader principles of community engagement in environmental planning, wherein inclusive stakeholder consultation strengthens the acceptance, maintenance, and long-term effectiveness of infrastructure interventions (Santiago, 2025b).

In 2017, the first batch of trash traps composed of three (3) units were installed in the Municipality of Naic, Cavite. These are gate-typed where the stream force is used to push the trash into the trash trap wings and once the trap can no longer accommodate the load of the trapped garbage, the wheel will be manually released to open the gate in order to avoid damages on the unit (see Figure 6 and 7).

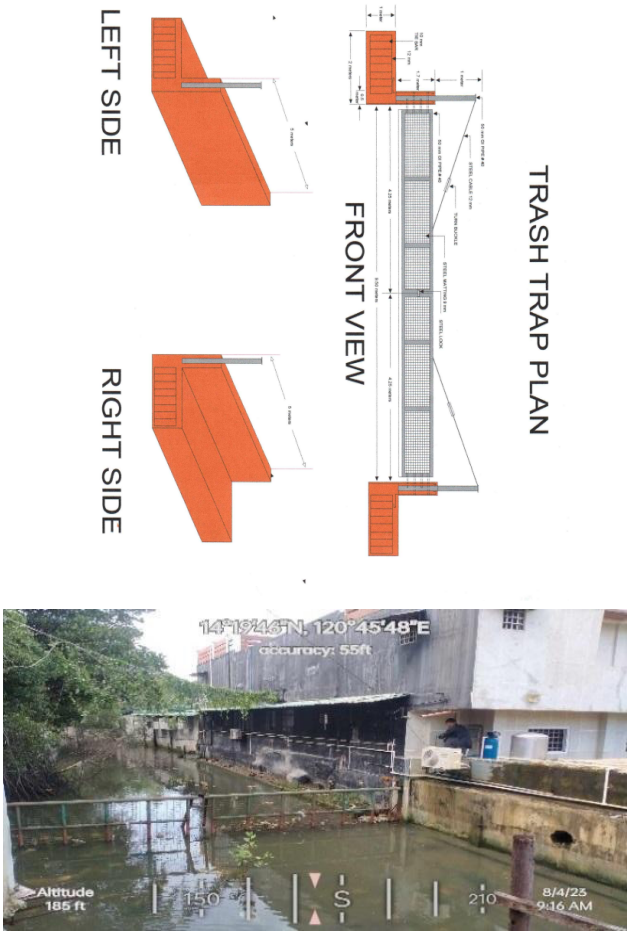
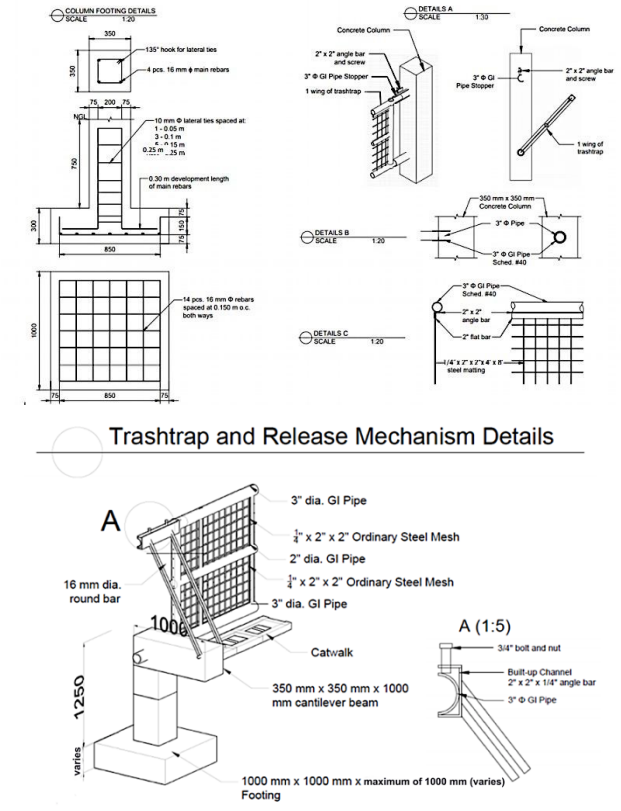


Figure 6 and 7. The (a) Design and (b) Actual photo of the Gate-typed Trash Trap installed in Brgy. Bucana Sasahan, Naic, Cavite.

The second batch of trash traps composed of 10 units were installed in 2019 in the Municipality of Kawit and the Cities of Bacoor and Imus, Cavite. Over the years, it has been observed that although effective, clogging and/or passing through of solid wastes within the trash trap wings were inevitable due to manual mechanism. Thus, observations and experiences relative to trash trap installation resulted in the improvement of its effectiveness thru modifications in the design.

The pandemic in 2020 has not been a hindrance to the implementation of the MBRP, thus, 20 trash traps with improved design were installed in the Municipalities of Silang and Tanza, and the Cities of Imus, Gen. Trias and Dasmariñas, Cavite. These are collapsible-typed where the stream force is used to push the garbage into the trash trap wings and once the trap can no longer accommodate the load of the trapped garbage, the wheel will then be mechanically released causing the trap wings to collapse and retain the garbage in the trap. This mechanism suppressed clogging and allowed stream water to flow through the trap as efficiently as possible (see Figures 8-12).



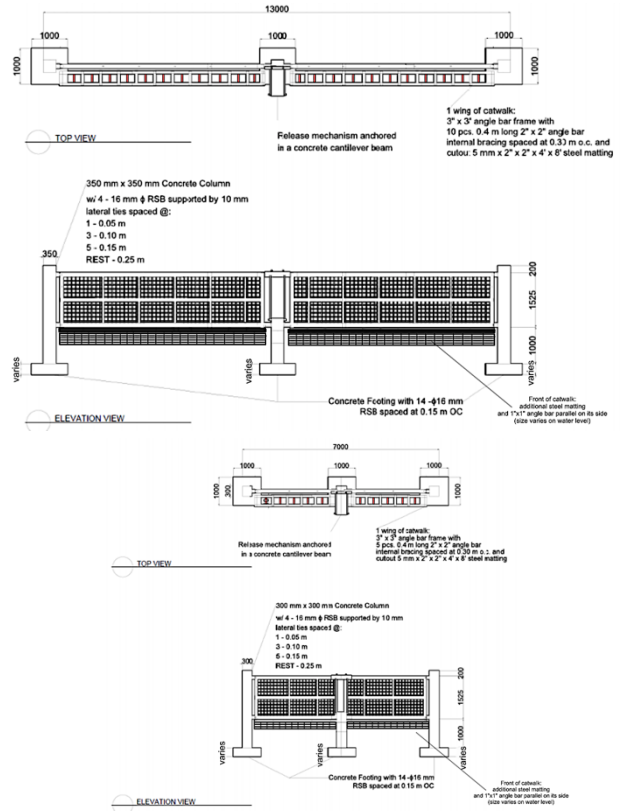


Figure 8-12. The (a - e) Designs and (f) Actual photo of the Collapsible-typed Trash Trap installed in Brgy. Langkaan I, Dasmariñas City, Cavite.

Thereafter, the succeeding installed units were all collapsible-typed. In 2021, five (5) units were installed in the Municipality of Silang and Cities of Gen. Trias and Trece Martires, Cavite. In 2022, 10 units were installed in the Municipalities of Ternate, Tanza, Rosario, Naic, Mendez, Magallanes and General Emilio Aguinaldo, Cavite.

Recently, one (1) unit was installed in the City of Bacoor as per request of Sen. Cynthia Villar so that the garbage in the waterways of Cavite will no longer reach the waterways within the jurisdiction of the City of Las Piñas, Metro Manila because it is situated in the boundary of Bacoor City and Las Piñas, City (see Figure 13). The unit was already completed on February 03, 2023.

Figure 13. The Actual photo of the Collapsible-typed Trash Trap installed in Brgy. San Nicholas III, Bacoor City, Cavite.

To date, there are forty-nine (49) installed trash traps within the river systems of Cavite which made the collection of solid wastes easier, which in turn assisted in alleviating water pollution.

Relative to the trash trap installation project, DENR – PENRO Cavite has shouldered the whole expenses thru the MBSCMO fund, starting from installation until the continuous maintenance efforts to be able to attain its goal.

The Solid Waste Collection from the Installed Trash Traps

MBSCMO Cavite is continuously consolidating the data obtained by the hired River Rangers from their daily solid waste collection reports on the installed trash traps (see Annex). The trapped wastes are being collected, weighed, segregated and transferred into the designated pick-up points by the assigned RRs to facilitate hauling by the contracted garbage hauler of the respective cities and municipalities. Hence, Team Leaders per city/municipality are being trained in data collection.

The first year of monitoring the efficiency of the installed trash traps started in 2021. Based on the gathered data, it was found that out of the 38 installed trash traps, 50% or 19 units are functional and in good condition (FGC), 13% or five (5) units are functional with minor damaged (FMD), 13% or five (5) units are newly installed, 21% or eight (8) units are not functional and severely damaged (NFSD), and 3% or one (1) unit has been washed-out due to typhoon Fabian.

Likewise, out of the classified trash traps as FGD and FMD, only 58% or 14 units have waste collection, but

it is noticeable that there is also waste collection in 50% or four (4) trash traps classified as NFSD. Hence, the total volume of waste collected in the 38 installed trash traps in 2021 is 669,091 kgs (see Table 1).

Table 1. Solid Waste Collection from the Installed Trash Traps for CY 2021

No.	Year Est.	City/ Municipality	Barangay	Coordinates		Approx. Length (M)	Status	River System	Volume Collected (Kg)
				Northing	Easting				
1	2019	City of Bacoor	Molino VI (Phase 4)	14.4169	120.9758	10	FGC	Zapote River	No collection
2	2019	City of Bacoor	Aniban IV	14.4564	120.9686	8	FGC	Zapote River	No collection
3	2019	City of Bacoor	Molino VI (Woodwinds)	14.4119	120.9869	8	FGC	Zapote River	No collection
4	2019	City of Bacoor	Ligas I	14.4539	120.9681	4	FGC	Zapote River	206,883
5	2019	City of Bacoor	Ligas II	14.4515	120.9661	8	FGC	Zapote River	199,971
6	2019	City of Bacoor	Molino V	14.3963	120.9688	6	FGC	Zapote River	84,801
7	2019	City of Bacoor	Real 2	14.4354	120.9499	8	FGC	Imus River	122,127
8	2020	Dasmariñas City	Salawag (Pasong Tinta)	14.351984	120.977131	6	FGC	Imus River	No collection
9	2020	Dasmariñas City	Salitran III	14.352385	120.946027	6	NFSD	Imus River	No collection
10	2020	Dasmariñas City	Salawag (Prinza Dam)	14.350329	120.971077	8	FMD	Imus River	No collection
11	2020	Dasmariñas City	Burol II/Sta. Fe/Area C	14.323573	120.965355	4	FMD	Imus River	No collection
12	2020	Dasmariñas City	Sampaloc I (Robinsons Pala Pala)	14.300431	120.952461	8	NFSD	Imus River	No collection
13	2020	Dasmariñas City	Langkaan I (FCIE)	14 17'34"	120 56'6"	6	NFSD	Ylang-ylang River	No collection
14	2020	Dasmariñas City	Sabang	14.349885	120.924361	4	FGC	Imus River	No collection
15	2020	General Trias City	Navarro	14.3846	120.885274	8	FMD	Ylang-ylang River	400
16	2020	General Trias City	Santiago	14.34142	120.90905	12	FMD	Ylang-ylang River	600
17	2021	General Trias City	Manggahan	14.29154	120.906051	17	Newly installed	Cañas River	-
18	2021	General Trias City	Biclatan	14.28217	120.90541	12	Newly installed	Cañas River	-
19	2020	Imus City	Toclong IA	14.431437	120.932774	5	NFSD	Imus River	24,600
20	2020	Imus City	Anabu 2F	14.36135	120.92922	8	NFSD	Imus River	8,960
21	2020	Imus City	Alapan IC	14.405483	120.920958	6	FGC	Imus River	1,800
22	2020	Imus City	Malagasang 2B	14.369541	120.918914	6	FGC	Imus River	5,900
23	2020	Imus City	Malagasang 2C	14.354327	120.923545	4	FGC	Imus River	No collection
24	2019	Imus City	Pasong Buaya II	14.38721	120.96225	8	FGC	Imus River	3,000
25	2019	Imus City	Buhay na Tubig	14.420229	120.949706	6	FGC	Imus River	3,600
26	2020	Kawit	Toclong	14.42254	120.91512	6	FGC	Ylang-ylang River	No collection
27	2019	Kawit	Aplaya	14.45208	120.91813	8	FGC	Ylang-ylang River	470
28	2017	Naic	Palangue 2&3	14.250749	120.837228	5	FGC	Labac River	595
29	2017	Naic	San Roque	14.310035	120.7706	12	FGC	Labac River	1,050
30	2017	Naic	Bucana Sasahan	14.329549	120.763565	8	FGC	Labac River	800
31	2020	Silang	Sabutan	14.23297	120.97834	6	NFSD	Imus River	No collection
32	2020	Silang	Luksuhin	14.2104	120.9562	8	FMD	Ylang-ylang River	No collection
33	2021	Silang	Adlas	14.256	120.9695	8	Newly installed	Ylang-ylang Rio Grande River	-
34	2020	Tanza	Biwas	14.39993	120.8558	8	Washed-out due to typhoon Fabian	Cañas River	1,075
35	2020	Tanza	Daang Amaya I	14.39426	120.85771	8	NFSD	Cañas River	1,489
36	2020	Tanza	Paradahan I	14.32065	120.86688	12	NFSD	Cañas River	970
37	2021	Trece Martires City	Inocencio	14.26329	120.87545	10	Newly installed	Labac River	-
38	2021	Trece Martires City	Luciano	14.27813	120.86538	8	Newly installed	Labac River	-
			GRAND TOTAL						669,091

On the second year of monitoring, it was found that out of the 48 installed trash traps, 58.3% or 28 units are FGC, 8.3% or four (4) units are FMD, 8.3% or four (4) units are NFSD, 21% or 10 units have been washed-out due to typhoon Paeng, and 4.1% or two (2) units have been dismantled due to ongoing revetment project of the Department of Public Works and Highways (DPWH). The dismantled units in Brgy. Sabutan, Silang and Brgy. Molino VI (Phase 4), Bacoor City will be reinstalled by DPWH once the soil erosion measure/riprap in the aforementioned locations are finished. Further, out of the classified trash traps as FGD and FMD, only 6.25% or two (2) units have no garbage collection, but it was noted that there is garbage collection in 96% or 46 installed trash traps. Hence, the total volume of waste collected in the 48 installed trash traps in 2022 is 928,754 kgs (see Table 2).

Table 2. Solid Waste Collection from the Installed Trash Traps for CY 2022

No.	Year Est.	City/ Municipality	Barangay	Coordinates		Approx. Length (M)	Status	River System	Volume Collected (Kg)
				Northing	Easting				
1	2019	City of Bacoor	Molino VI (Phase 4)	14.4169	120.9758	10	Dismantled due to revetment project of DPWH	Zapote River	670,695.4
2	2019	City of Bacoor	Aniban IV	14.4564	120.9686	8	FGC	Zapote River	(combined)
3	2019	City of Bacoor	Molino VI (Woodwinds)	14.4119	120.9869	8	FMD	Zapote River	(combined)
4	2019	City of Bacoor	Ligas I	14.4539	120.9681	4	NFSD (Subject for repair)	Zapote River	(combined)
5	2019	City of Bacoor	Ligas II	14.4515	120.9661	8	FGC	Zapote River	(combined)
6	2019	City of Bacoor	Molino V	14.3963	120.9688	6	NFSD	Zapote River	(combined)
7	2019	City of Bacoor	Real 2	14.4354	120.9499	8	FGC	Imus River	(combined)
8	2020	Dasmariñas City	Salawag (Pasong Tinta)	14.351984	120.977131	6	Washed-out due to typhoon Paeng	Imus River	91,710
9	2020	Dasmariñas City	Salitran III	14.352385	120.946027	6	Washed-out due to typhoon Paeng	Imus River	(combined)
10	2020	Dasmariñas City	Salawag (Prinza Dam)	14.350329	120.971077	8	Washed-out due to typhoon Paeng	Imus River	(combined)
11	2020	Dasmariñas City	Burol II/Sta. Fe/Area C	14.323573	120.965355	4	FGC	Imus River	(combined)
12	2020	Dasmariñas City	Sampaloc I (Robinsons Pala Pala)	14.300431	120.952461	8	Washed-out due to typhoon Paeng	Imus River	(combined)

No.	Year Est.	City/ Municipality	Barangay	Coordinates		Approx. Length (M)	Status	River System	Volume Collected (Kg)
				Northing	Easting				
13	2020	Dasmariñas City	Langkaan I (FCIE)	14 17'34"	120 56'6"	6	FGC	Ylang-ylang River	(combined)
14	2020	Dasmariñas City	Sabang	14.349885	120.924361	4	FGC	Imus River	(combined)
15	2020	General Trias City	Navarro	14.3846	120.885274	8	Washed-out due to typhoon Paeng	Ylang-ylang River	5,589
16	2020	General Trias City	Santiago	14.34142	120.90905	12	Washed-out due to typhoon Paeng	Ylang-ylang River	(combined)
17	2021	General Trias City	Manggahan	14.29154	120.906051	17	NFSD	Cañas River	(combined)
18	2021	General Trias City	Biclatan	14.28217	120.90541	12	FMD	Cañas River	(combined)
19	2020	Imus City	Toclong IA	14.431437	120.932774	5	FGC	Imus River	128,587
20	2020	Imus City	Anabu 2F	14.36135	120.92922	8	FGC	Imus River	(combined)
21	2020	Imus City	Alapan IC	14.405483	120.920958	6	Washed-out due to typhoon Paeng	Imus River	(combined)
22	2020	Imus City	Malagasang 2B	14.369541	120.918914	6	FGC	Imus River	(combined)
23	2020	Imus City	Malagasang 2C	14.354327	120.923545	4	FGC	Imus River	(combined)
24	2019	Imus City	Pasong Buaya II	14.38721	120.96225	8	FGC	Imus River	(combined)
25	2019	Imus City	Buhay na Tubig	14.420229	120.949706	6	Washed-out due to typhoon Paeng	Imus River	(combined)
26	2020	Kawit	Toclong	14.42254	120.91512	6	FMD	Ylang-ylang River	6,261
27	2019	Kawit	Aplaya	14.45208	120.91813	8	FGC	Ylang-ylang River	(combined)
28	2017	Naic	Palangue 2&3	14.250749	120.837228	5	FGC	Labac River	10,643
29	2017	Naic	San Roque	14.310035	120.7706	12	FGC	Labac River	(combined)
30	2017	Naic	Bucana Sasahan	14.329549	120.763565	8	FGC	Labac River	(combined)
31	2022	Naic	San Roque (AMBS)	14.301329	120.779015	8	NFSD (ongoing repair)	Labac River	(combined)
32	2022	Naic	Makina	14.310075	120.770614	12	FGC	Labac River	(combined)
33	2020	Silang	Sabutan	14.23297	120.97834	6	Dismantled due to revetment project of DPWH	Imus River	7,586.50
34	2020	Silang	Luksuhin	14.2104	120.9562	8	FMD	Ylang-ylang River	(combined)
35	2021	Silang	Adlas	14.256	120.9695	8	FGC	Ylang-Ylang Rio Grande River	(combined)
36	2020	Tanza	Biwas	14.39993	120.8558	8	Washed-out due to typhoon Paeng	Cañas River	2,896
37	2020	Tanza	Daang Amaya I	14.39426	120.85771	8	FGC	Cañas River	(combined)
38	2020	Tanza	Paradahan I	14.32065	120.86688	12	Washed-out due to typhoon Paeng	Cañas River	(combined)
39	2022	Tanza	Amaya IV	14.38261	120.83126	5	FGC	Cañas River	(combined)
40	2022	Tanza	Borders of Julugan and Biwas	14.40563	120.84843	4	FGC	Cañas River	(combined)
41	2021	Trece Martires City	Inocencio	14.26329	120.87545	10	FGC	Labac River	2,180
42	2021	Trece Martires City	Luciano	14.27813	120.86538	8	FGC	Labac River	(combined)
43	2022	Ternate	Poblacion III	14 17'24"	120 43'0"	8	FGC	Maragondon River	20
44	2022	General Emilio Aguinaldo	Kaypaaba	14.18413	120.79254	15	FGC	Maragondon River	470
45	2022	Mendez	Palocpoc II	14.129915	120.873461	8	FGC	Maragondon River	No collection
46	2022	Magallanes	Poblacion III	14.18423	120.75534	15	FGC	Maragondon River	365
47	2022	Rosario	Ligtong IV	14.424848	120.86655	8	FGC	Ylang-ylang River	902
48	2022	General Mariano Alvarez	Maderan	14.2846	120.9961	8	FGC	Biñan River	No collection
					GRAND TOTAL				**928,754**

Due to time restriction, the third year of monitoring covers only until the 3rd quarter of 2023. It was found that out of the 49 installed trash traps, 45% or 22 units are FGC, 22% or 11 units are FMD, 2% or one (1) unit is not functional but in good condition (NFGC) and unfortunately 31% or 15 units are not functional and severely damaged (NFSD). Both minor and severely damaged were incurred during the onslaught of heavy rains from previous months and typhoons from previous years. At present, the two (2) units noted as NFSD are located in Brgy. Sabutan, Silang and Brgy. Molino VI (Phase 4), Bacoor were dismantled by DPWH due to revetment project. However, the said office will reinstall the dismantled trash traps once the soil erosion measure/riprap in the aforementioned locations are finished. Similarly, out of the classified trash traps as FGD and FMD, only 6% or two (2) units have no garbage collection but it was noted that there is garbage collection in 82% or 40 installed trash traps. Hence, the total volume of waste collected (as of 3rd quarter 2023) in the 49 installed trash traps in 2023 is 439,382 kgs (see Table 3).

Table 3. Solid Waste Collection from the Installed Trash Traps for CY 2023

No.	Year Est.	City/Municipality	Barangay	Coordinates		Approx. Length (M)	Status	River System	Volume Collected (Kg)
				Northing	Easting				
1	2019	City of Bacoor	Molino VI (Phase 4)	14.4169	120.9758	10	NFSD	Zapote River	2,213
2	2019	City of Bacoor	Aniban IV	14.4564	120.9686	8	NFSD	Zapote River	53,036
3	2019	City of Bacoor	Molino VI (Woodwinds)	14.4119	120.9869	8	FGC	Zapote River	13,870
4	2019	City of Bacoor	Ligas I	14.4539	120.9681	4	FGC	Zapote River	53,922
5	2019	City of Bacoor	Ligas II	14.4515	120.9661	8	FMD	Zapote River	71,951.40
6	2019	City of Bacoor	Molino V	14.3963	120.9688	6	FGC	Zapote River	67,139
7	2019	City of Bacoor	Real 2	14.4354	120.9499	8	FMD	Imus River	67,801.60
8	2023	City of Bacoor	San Nicholas III	14.4174	120.9688	6	FMD	Zapote River	No Collection
9	2020	Dasmariñas City	Salawag (Pasong Tinta)	14.351984	120.977131	6	NFSD	Imus River	1,650
10	2020	Dasmariñas City	Salitran III	14.352385	120.946027	6	NFSD	Imus River	No Collection
11	2020	Dasmariñas City	Salawag (Prinza Dam)	14.350329	120.971077	8	FGC	Imus River	No Collection
12	2020	Dasmariñas City	Burol II/Sta. Fe/Area C	14.323573	120.965355	4	NFSD	Imus River	1,770
13	2020	Dasmariñas City	Sampaloc I (Robinsons Pala Pala)	14.300431	120.952461	8	FGC	Imus River	No Collection
14	2020	Dasmariñas City	Langkaan I (FCIE)	14 17'34"	120 56'6"	6	NFSD	Ylang-ylang River	1,045
15	2020	Dasmariñas City	Sabang	14.349885	120.924361	4	FGC	Imus River	2,600
16	2020	General Trias City	Navarro	14.3846	120.885274	8	NFSD	Ylang-ylang River	No Collection
17	2020	General Trias City	Santiago	14.34142	120.90905	12	FMD	Ylang-ylang River	710
18	2021	General Trias City	Manggahan	14.29154	120.906051	17	FGC	Cañas River	287
19	2021	General Trias City	Biclatan	14.28217	120.90541	12	FMD	Cañas River	339

No.	Year Est.	City/Municipality	Barangay	Coordinates		Approx. Length (M)	Status	River System	Volume Collected (Kg)
				Northing	Easting				
20	2020	Imus City	Toclong IA	14.431437	120.932774	5	FGC	Imus River	22,244
21	2020	Imus City	Anabu 2F	14.36135	120.92922	8	FMD	Imus River	No Collection
22	2020	Imus City	Alapan IC	14.405483	120.920958	6	FGC	Imus River	15,071
23	2020	Imus City	Malagasang 2B	14.369541	120.918914	6	FMD	Imus River	5,907
24	2020	Imus City	Malagasang 2C	14.354327	120.923545	4	FGC	Imus River	3,994
25	2019	Imus City	Pasong Buaya II	14.38721	120.96225	8	FGC	Imus River	15,253
26	2019	Imus City	Buhay na Tubig	14.420229	120.949706	6	NFSD	Imus River	No Collection
27	2020	Kawit	Toclong	14.42254	120.91512	6	NFSD	Ylang-ylang River	1,170
28	2019	Kawit	Aplaya	14.45208	120.91813	8	NFSD	Ylang-ylang River	582
29	2017	Naic	Palangue 2&3	14.250749	120.837228	5	FGC	Labac River	3,814
30	2017	Naic	San Roque	14.310035	120.7706	12	FGC	Labac River	2,304
31	2017	Naic	Bucana Sasahan	14.329549	120.763565	8	FMD	Labac River	523
32	2022	Naic	San Roque (AMBS)	14.301329	120.779015	8	NFSD	Labac River	No Collection
33	2022	Naic	Makina	14.310075	120.770614	12	FGC	Labac River	1,392
34	2020	Silang	Sabutan	14.23297	120.97834	6	NFSD	Imus River	No Collection
35	2020	Silang	Luksuhin	14.2104	120.9562	8	FGC	Ylang-ylang River	1,746
36	2021	Silang	Adlas	14.256	120.9695	8	FMD	Ylang-Ylang Rio Grande River	2,431
37	2020	Tanza	Biwas	14.39993	120.8558	8	NFSD	Cañas River	1,510
38	2020	Tanza	Daang Amaya I	14.39426	120.85771	8	FGC	Cañas River	6,750
39	2020	Tanza	Paradahan I	14.32065	120.866888	12	NFSD	Cañas River	1,550
40	2022	Tanza	Amaya IV	14.38261	120.83126	5	FGC	Cañas River	4,300
41	2022	Tanza	Borders of Julugan and Biwas	14.40563	120.848843	4	NFSD	Cañas River	1,550
42	2021	Trece Martires City	Inocencio	14.26329	120.87545	10	FGC	Labac River	166
43	2021	Trece Martires City	Luciano	14.27813	120.865388	8	FMD	Labac River	498
44	2022	Ternate	Poblacion III	14 17'24"	120 43'0"	8	NFGC	Maragondon River	484
45	2022	General Emilio Aguinaldo	Kaypaaba	14.18413	120.792574	15	FGC	Maragondon River	2,319
46	2022	Mendez	Palocpoc II	14.129915	120.873461	8	FGC	Maragondon River	390
47	2022	Magallanes	Poblacion III	14.18423	120.75534	15	FGC	Maragondon River	584
48	2022	Rosario	Ligtong IV	14.424848	120.86655	8	FGC	Ylang-ylang River	496
49	2022	General Mariano Alvarez	Maderan	14.2846	120.9961	8	FMD	Biñan River	4,019
				GRAND TOTAL					**439,382**

Based on the processed data, it is noticeable that within the three (3)-year period (2021–2023) of the trash trap installation project, the average functional trash trap is 66% while the average non-functional trash trap is 34%. However, the installed units had already captured a total volume of 2,037,227 kgs, or equivalent to 2,005.1 tons of mixed wastes, an indication that RRs are also conducting clean-up activities in trash traps classified as NFSD (see Table 4). Nonetheless, the efficiency of these traps can be maximized if all units are functional and are maintained in good condition. The huge volume of solid wastes that are being trapped and are not able to reach the Manila Bay area is a great help in the ongoing efforts to clean up, rehabilitate, and preserve the said valuable waterbody.

Table 4. Summary of Trash Trap Status relative to the Volume of Wastes Collected.

Year	Average Percentage of Functional Trash Trap	Average Percentage of Non-Functional Trash Trap	Total Volume of Wastes Collected (Kg)	(+) / (-) In Waste Collected (Kg)	% (+) / % (-) In Waste Collected
2021	66%	34%	669,091	—	—
2022			928,754	259,663	+72%
2023			439,382	-489,372	-211%
	GRAND TOTAL		**2,037,227**		

Likewise, it has been observed that an increase of 72% or 259,663 kgs (256 tons) of waste collected in 2022 along the rivers/tributaries/waterways is because of the outbreak of the pandemic, wherein most of the wastes collected are composed of COVID-19-related healthcare wastes such as facemasks and face shields. It was in 2023 (as of the 3rd quarter), when a notable decrease of -211% or -489,372 kgs (482 tons) in solid waste collection from the installed trash traps was recorded. The aforementioned positive result is the outcome of various interventions being undertaken by MBSCMO Cavite, such as intensified Communication, Education, and Public Awareness (CEPA) Campaign among the residents, especially those living in the easement areas/waterways. The establishment of barangay ecological gardens and the installation of billboards and vertical fences with gardens are useful in proper waste management.

CONCLUSION AND RECOMMENDATIONS

The uncontrolled solid waste generation ending up in the waterways of the Province of Cavite, draining into Manila Bay, is a serious environmental problem that threatens the natural environment as well as the biodiversity in the Manila Bay Region. In support of the continuous efforts of the Manila Bay Rehabilitation Program (MBRP) as part of the Supreme Court Continuing Mandamus Order, DENR–PENRO Cavite, through MBSCMO, has installed 49 trash traps that are strategically located within the river systems of Cavite, for the improvement of the quality of water in the rivers and waterways draining to Manila Bay.

Similarly, the installed units will reduce the flow of solid wastes coming from the upstream, and facilitate easier collection and safe disposal, which contributes to the prevention of water pollution. Based on the processed data from 2021 – 2023 regarding the trash trap installation project, it was found that the average functional trash traps are 66%, while the average non-functional trash traps are 34%. However, the installed units had already captured a total volume of 2,037,227 kgs, or equivalent to 2,005.1 tons of mixed wastes, an indication that RRs are also conducting clean-up activities in trash traps classified as NFSD.

Moreover, the following are some of the probable situational conditions that influence the variation in solid waste collection by means of trash traps, to wit: (a) RRs were unable to visit all units since they are focused on the reported hotspot areas under their jurisdiction; (b) effective/strengthened enforcement of existing environmental laws, rules and regulations—a priority well-documented in the context of Philippine governance and anti-corruption frameworks (Santiago, 2018); and, (c) conduct of intensified Communication, Education and Public Awareness (CEPA) Campaign among the residents especially those living in the easement areas/waterways.

Nonetheless, the efficiency of these traps can be maximized if all units are functional and are maintained in good condition. Thus, all the installed units must be functional and in good condition to be able to respond to the dire need to control the additional leakage of wastes into our waterbodies. Correspondingly, it is noteworthy to state that the huge volume of solid wastes that are being trapped before reaching the Manila Bay area is of great help in the ongoing efforts to clean up, rehabilitate, and preserve the said valuable waterbody.

Recommendations

In view of the foregoing, the following are hereby recommended to wit:

1. That the 49 installed trash traps within the Province of Cavite under the Manila Bay Rehabilitation Program be turned over through a Memorandum of Agreement (MOA) to the respective Local Government Units where they are located. The said MOA will legally bind both parties to ensure collaborative efforts in the maintenance of the project to be able to serve its purpose.
2. The trash trap installation project should be replicated in applicable waterways since it is an effective measure in trapping solid wastes within waterways. The replication process should be guided by participatory planning principles and supported by transparent data management practices that align with data privacy and research ethics standards (Santiago, 2024).

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Environmental and Urban Planning International Journal

EUPIJ

Safety First: Sustaining Workplace Practices in Small and Medium Enterprises in Albay, Philippines

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ABSTRACT

This study focused on assessing the level of Occupational Safety and Health compliance among Small and Medium Enterprises in Albay, Philippines, with particular attention to perceived compliance, local practices, challenges, and the development of policy recommendations. An explanatory sequential mixed-methods design was employed, beginning with a Likert-scale survey to measure OSH compliance across the six indicators among SMEs in the study area, followed by key informant interviews with OSH officers, medical officers, and the CEOs to provide qualitative insights that explained and enriched the survey findings. Findings revealed that Urban districts like Legazpi City and Daraga lead in compliance because of strong governance, training, and inspections, while Tabaco City and Ligao City show moderate compliance but struggle with cultural resistance, slowing adoption of safety practices, and rural districts such as Polangui, Oas, Guinobatan, and Camalig lag behind due to weak incentives, limited resources, and poor training access. The SME-Integrated OSH Compliance Model ties these insights together, showing that governance, culture, inspections, incentives, and training must work together to build a sustainable safety culture across Albay. The assessment of SME-Integrated OSH compliance in Albay highlights a clear tiered performance across districts, with urban centers leading through strong governance and structured training, mid-tier districts struggling with cultural adoption, and rural areas lagging due to resource and training gaps. Urban best practices such as leadership commitment, inspections, and incentives, offer replicable models, but persistent challenges like weak incentives, resistance to change, and limited resources confirm SMEs' structural disadvantages compared to larger firms. Addressing these gaps through targeted interventions and support mechanisms is essential to ensure equitable compliance outcomes. The SME-Integrated OSH Compliance Model provides a comprehensive framework that integrates governance, culture, inspections, incentives, and skills development, converging on the goal of building a sustainable workplace safety culture across Albay. The practical implication of this study is that policymakers must apply a tiered approach, replicating urban best practices, strengthening communication in mid-tier districts, and expanding incentives and training access in rural SMEs to build a sustainable workplace safety culture in Albay.

Keywords: *OSH, SME, OSH-Compliance, Compliance Incentive, Risk Management, Organizational Commitment, Urban, Rural*

INTRODUCTION

Occupational safety and health (OSH) standards play a pivotal role in ensuring the well-being of employees and maintaining a secure work environment (WHO, 2023). With about 60% of the global population is employed, and every worker is entitled to a work environment that is secure and promotes well-being (WHO, 2023). Decent work provides not only income but also fosters confidence, purpose, and a sense of achievement. It provides opportunities for positive relationships and community inclusion, offering a foundation for structured routines and numerous other benefits. It fosters positive relationships, community inclusion, and structured routines that benefit individuals and society. For those facing mental health challenges, decent work becomes even more important, supporting recovery and improving social functioning (Mabona, et al., 2022). According to Mabona et al. (2022), workplaces that prioritize OSH reduce stress and conflict, improve staff retention, and increase productivity. Conversely, they

stressed that when safety systems are weak, especially for vulnerable workers, job satisfaction and performance decline, attendance suffers, and employment opportunities may be lost. As industries evolve and the workplace grows more complex, assessing OSH-compliance becomes increasingly necessary (Tamers et al., 2020; Mabona et al., 2022).

Globally, the OSH has been recognized as a critical aspect of workforce management, e.g., the International Labor Organization (ILO) and the World Health Organization (WHO). The ILO's OSH Convention No. 155 and its 2002 Protocol emphasize the responsibility of government and employees to uphold workers' right to safe and healthy workplace (Wadsworth & Walters, 2019). In the United States of America, the Occupational Safety and Health Administration was created following the passage of the OSH Act of 1970 to ensure workers have a safe and healthy workplace. This was achieved by setting rules and offering training in the workplace (Centers for Disease Control and Prevention, 2022; Fairfax, 2020). A strong organizational commitment to safety helped reduce accidents and hazards (Naji et al., 2021; Centers for Disease Control and Prevention, 2022; Mabona et al., 2022). Proper safety training equips employees with the skills they need to handle risks, while OSH-compliance ensures that industries follow legal and ethical practices (Dyreborg et al., 2022; Tamers et al., 2020).

In the Philippines, the legislative framework for OSH is anchored on Republic Act No. 11058. Enacted in 2018, this mandate requires employees to maintain safe working conditions and provide necessary safety equipment and training. The Department of Labor and Employment (DOLE) of the Philippines enforces OSH regulations and issues compliance directives such as Department Order No. 198 to implement the OSH Standards Act of 2018. Small and medium Enterprises (SMEs) in the Philippines are presently challenged in meeting OSH-compliance standards. At the local level, industries in Albay, including agriculture, construction, and manufacturing, are required to comply with OSH regulations. Yet, compliance remains uneven, and employers struggle to afford standard safety equipment and/or send their workers to training.

This study seeks to identify areas for improvement and ensure employees are properly equipped with knowledge and skills.

MATERIALS AND METHODS

This study used an explanatory sequential mixed methods design, starting with a survey to measure or describe the OSH compliance level among SMEs in Albay, Philippines, and then followed up with the OSH officers, medical officers, and CEOs, to explain the results of the survey. A likert scale was used to combine survey data and administrative insights to describe the level of compliance and get a clear understanding of OSH compliance of selected SMEs in the study area.

The approach structured the questionnaire to assess OSH compliance across six key indicators: regulatory standards, incentives, inspections, enforcement, information dissemination, and training. Respondents rated their organizations using a Likert scale, allowing for a systematic evaluation of perceived compliance levels. The approach provides a consistent framework for comparing practices across SMEs and identifying areas for deeper inquiry.

To complement the survey data, the study conducted targeted interviews with key informants from selected SMEs in three congressional districts of Albay Province. Participants were chosen based on strategic criteria to ensure representation of samples facing compliance challenges. The interviews explored behavioral, operational, and administrative factors affecting OSH implementation. Thematic coding was applied to extract patterns and insights that could not be captured through quantitative methods alone.

By combining survey data with interview findings, the study adopted a mixed-method approach to develop a comprehensive policy framework. This integration allowed for the construction of the SME-integrated OSH Compliance Model, as shown in Figure 1, which aligns technical standards with organizational strategies. The model was designed to reflect both the formal structure and lived experiences of SMEs, ensuring that proposed interventions are grounded, practical, and responsive to real-world conditions.

RESULTS AND DISCUSSION

Table 1 presents the summary of OSH compliance among selected SMEs in Albay, Philippines. It highlights the sample SME names (coded by district), the compliance indicators assessed, their mean scores, and interpretations.

By linking each compliance theme, such as training, organizational commitment, inspections, incentives, enforcement, and risk management to specific SMEs, the table discloses both strengths and gaps in

workplace safety practices. This structured view shows that SMEs demonstrate a strong commitment to training and policy formulation, but they face challenges in sustaining compliance incentives and proactive risk management.

Table 1. Matrix of OSH Compliance, Practices, and Challenges in Albay SMEs

Indicators	Rating	Sample SMEs by District	Compliance Level	Best Practices	Challenges	Findings
Training initiatives (mandatory training, drills, refresher courses)	4.60-4.67	District 1 (Legazpi) / District 2 (Daraga)	Very High	Structured training programs, regular drills	Resource gaps in rural areas	SMEs prioritize training as their strongest compliance tool Training is the highest-performing area, ensuring workers are well-prepared
Formulation of regulatory standards (policies, OSH committees, integration)	4.40 – 4.60	District 2 (Daraga) / District 3 (Tabaco)	High	Embedding OSH into policies and committees	Limited resources for smaller SMEs	SMEs embed OSH into decision-making despite resource challenges Strong structural commitment shows maturity in compliance culture
Inspection by regulatory agencies (regular inspections, documentation, audits)	3.93-4.27	District 1 (Legazpi) / District 3 (Tabaco)	Moderate to High	Cooperation with external audits	Weak transparency to employees	SMEs cooperate with external oversight but transparency to employees is weaker Compliance is high in inspections, but internal communication needs improvement
Financial incentives, government contract priority, employee rewards	3.20 – 3.93	District 2 (Daraga) / District 3 (Tabaco)	Low to Moderate	Employee recognition, contract prioritization	Lack of subsidies and external motivation	SMEs lack external financial motivation, treating safety as a cost Incentives are the weakest area, creating sustainability challenges
Enforcement by regulatory agencies (sanctions, accountability, legal awareness)	3.80 – 4.33	District 1 (Legazpi) / District 2 (Daraga)	Moderate to High	Legal awareness, accountability systems	Compliance driven by fear of sanctions	SMEs comply mainly to avoid penalties, showing reactive rather than proactive behavior Fear of sanctions drives compliance, but proactive safety culture is limited
Dedicated OSH committees, integration into company policies	4.40 – 4.60	District 3 (Tabaco) / District 2 (Daraga)	High	Strong internal OSH committees	Maintaining consistency in smaller firms	SMEs demonstrate strong internal commitment to safety structures OSH is integrated into organizational culture, ensuring long-term adherence

The SME-Integrated OSH Compliance Model, as shown in Figure 1, is a policy framework developed to strengthen workplace safety among small and medium enterprises (SMEs) in Albay. It was designed by combining quantitative survey results with qualitative interview insights, ensuring that both statistical evidence and real-world experiences shaped its structure. The model organizes the determinants of OSH compliance, such as regulatory mechanisms, industry context, challenges, and best practices, into a layered framework that explains how compliance can be achieved and sustained.

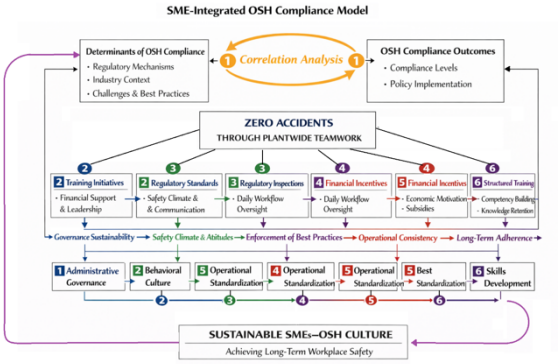

Figure 1. SME-Integrated OSH Compliance Model (Livica, 2026)

The Benchmarking Matrix serves as a practical tool for policymakers and industry leaders to evaluate how compliance drivers (arrows) connect to strategic domains and how these domains perform across districts in Albay. By mapping arrows to governance, culture, standardization, best practices, and skills development, the matrix provides a clear picture of strengths, weaknesses, and intervention priorities.
This policy brief highlights the tiered performance across districts:

- Urban centers (Legazpi, Daraga) demonstrate strong governance and compliance, setting benchmarks for replication.
- Mid-tier districts (Tabaco, Ligao) show moderate adoption of safety culture, requiring communication-focused interventions.
- Rural districts (Polangui, Oas, Guinobatan, Camalig) face resource shortages, weak incentives, and limited training access, underscoring the need for targeted support.

Table 2 shows the convergence on the capstone goal: building a Sustainable SMEs–OSH Culture, consistent with ILO (2020) and Micheli et al. (2018), who confirm that integrated approaches—combining governance, culture, inspections, incentives, and training—are the most effective pathway to resilient compliance.
Each arrow explains how the compliance model, as shown in Figure 1, works in real life, and the

benchmarking matrix shows which districts are strong and which are weak in those areas. Urban districts lead, mid-tier districts struggle with culture, and rural districts face shortages in resources and training.

Table 2. OSH-SME Benchmarking in Albay, Philippines

Arrow	Role/Function	Strong Districts (Benchmark)	Weak Districts (Gap)
Arrow 1	Links rules, context, and challenges with compliance results	Legazpi, Daraga – strong feedback loop between policy and outcomes	Rural districts – weak correlation due to limited resources
Arrow 2	Training sustains leadership and financial support	Legazpi, Daraga – governance strengthened by structured training	Rural areas – governance gaps from limited training access
Arrow 3	Standards foster communication and reduce resistance	Urban centers – clearer adoption of safety culture	Tabaco, Ligao – moderate compliance; cultural barriers persist
Arrow 4	Inspections embed safety into daily workflows	Urban districts – regular audits sustain standardization	Polangui, Guinobatan – weak enforcement, poor workflow integration
Arrow 5	Incentives motivate SMEs to sustain compliance	Urban districts – stronger incentive structures	Rural districts – weakest incentives, lack subsidies and recognition
Arrow 6	Structured training ensures competency retention	Urban districts – accessible training programs	Oas, Camalig – severe training gaps, weak leadership support

CONCLUSION

The compliance assessment across Albay's SMEs reveals a stratified performance landscape, with urban districts such as Legazpi and Daraga leading due to strong oversight and inspections, mid-tier districts like Tabaco and Ligao showing moderate compliance shaped by cultural resistance, and rural districts consistently lagging because of resource shortages and weak incentives. This stratification confirms the need for a tiered policy approach that aligns interventions with district-specific realities, ensuring that governance structures and compliance mechanisms are tailored to local contexts.

Urban districts demonstrate that strong governance, structured training, and consistent inspections are the most effective drivers of compliance. Their integration of safety into daily operations, backed by leadership commitment and financial support, highlights replicable models that can be extended to other districts. Incentive structures in these areas further motivate SMEs to adopt best practices, reinforcing the importance of combining regulatory enforcement with positive reinforcement to sustain workplace safety culture.

Despite these successes, persistent barriers undermine progress. Weak incentives in rural areas, cultural resistance in mid-tier districts, leadership gaps in micro-enterprises, and resource constraints across disadvantaged regions confirm the structural disadvantages SMEs face compared to larger firms. These challenges emphasize the urgency of targeted interventions—financial subsidies, communication campaigns, leadership development, and expanded training access—to close compliance gaps and ensure equitable safety outcomes across all districts.

SME-Integrated OSH Compliance Model provides a comprehensive framework that organizes compliance drivers into four domains: Administrative Governance, Behavioral Culture, Operational Standardization, and Skills Development. By linking training, standards, inspections, incentives, and structured training to these domains, the model converges on the capstone goal of a Sustainable SMEs–OSH Culture. This integrated approach, consistent with global insights from ILO (2020) and Micheli et al. (2018), confirms that combining governance, culture, inspections, incentives, and training is the most effective pathway to resilient compliance and long-term workplace safety in Albay.

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Environmental and Urban Planning International Journal

Sustaining Local Enterprise: Adaptive MSMEs in Flood-Prone Areas in the Third District of Albay, Philippines

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ABSTRACT

This paper develops and presents an Integrated Logical Framework for MSME Capability Context in Flood Risk Management in the 3rd District of Albay, synthesizing government support, recurring challenges, and best practices into a diagnostic and developmental model that strengthens enterprise resilience, continuity, and community safety within the Quinali "A" Watershed. The study employed a descriptive-assessment method using surveys, interviews, and document reviews, guided by structured rubrics to evaluate MSMEs' flood risk management capabilities, practices, government support, and resilience gaps in the study area. The study found that MSMEs in Oas, Polangui, and Libon demonstrate moderate capability (2.5 to 3.4 rating) in flood risk management, with strengths in asset protection and adaptive operations but persistent weakness in financial preparedness and government support. Best practices were largely adopted (3.5 to 4.4) in Oas, while Polangui and Libon showed only partial adoption (2.5 to 3.4), reflecting uneven resilience capacities across municipalities. Overall, MSMEs "often" (3.4 to 4.4) encounter gaps in finance, market retention, and policy implementation, underscoring the need for target interventions, strong PPP engagement, and proactive government support to achieve sustainable resilience.

Keywords: *MSMEs, Flood Risk, Business Continuity, DRR, Safety, Economic Development*

INTRODUCTION

The Quinali "A" Watershed in Albay has been the subject of several studies on multi-hazard impacts and flood risk (Madriaga, 2023; Awah, et al., 2024), including works by Singson et al. (2023), Mendoza et al. (2025), and the Asia-Pacific Network for Global Change Research (2022), which highlight its vulnerability (Mendoza et al., 2025) to floods and other hazards. Hydrologic modeling studies further emphasize the watershed's floodplain dynamics, underscoring the need for localized MSME resilience frameworks (Bañares et al., 2024; Napay & Luyun, 2018).

MSMEs in flood-prone municipalities of the Quinali "A" Watershed, particularly Oas, Polangui, and Libon, face significant challenges in flood risk management due to the absence of localized frameworks, leaving them vulnerable to operational disruptions and long-term sustainability risks (Quesada-Román et al., 2025). Flood risk method for scarce-data catchments and municipalities (Quesada-Román et al., 2025). While broader studies on MSME resilience exist (Agarwal et al., 2023; Gupta & Singh, 2023; Supari & Anton. 2022; Anggadwita. 2021; Anatan, 2021), localized research remains scarce, with limited data on disaster risk reduction integration, economic losses, and recovery mechanisms (Skouloudis, 2023; Vasquez et al., 2021; Khurana, 2021; Skivington, 2021) to develop a Capability Context Model tailored to MSMEs in the watershed, offering actionable strategies for owners, LGUs, and national agencies to strengthen preparedness, adaptive capacity, and sustainable economic development.

The conceptual framework for this study draws strength from the triangulation of Resource-Based View Theory (Agarwal et al., 2023; Barney, 1991), Resilience Theory (Ballesteros & Domingo, 2023), and Stakeholder Theory (Skouloudis, 2023) to examine how MSMEs in the Quinali "A" Watershed build adaptive capacity against flood risks. The framework provides a structured lens for analyzing resilience, highlighting four interconnected components: (i) capability, (ii) practices/strategies, (iii) gaps, (iv) challenges, and institutional support

that collectively shape MSME resilience. Figure 1 emphasizes that MSMEs' specific assets are critical for sustaining competitive advantage and resilience (Barney, 1991; Agarwal et al., 2023). Studies in the Philippines context confirm that MSMEs often face financial constraints (Vasquez et al., 2021), operational disruptions, and weak retention following flood events (Ballesteros & Domingo, 2023).

Government and institutional support, through policies, financial aid, and PPP (Bhat, 2021) initiatives, plays a pivotal role in bringing these gaps and reinforcing resilience. This aligns with stakeholder theory, which underscores the importance of coordinated actions among public and private institutions and agencies, including the MSMEs communities (Freeman, 1884; Skouloudis, 2023).

The Logical Framework for MSME Capability Context in Flood Risk Management in Albay's 3rd District, combining government support, challenges, and best practices into a model that strengthens resilience, business continuity, and community safety within the Quinali "A" Watershed.

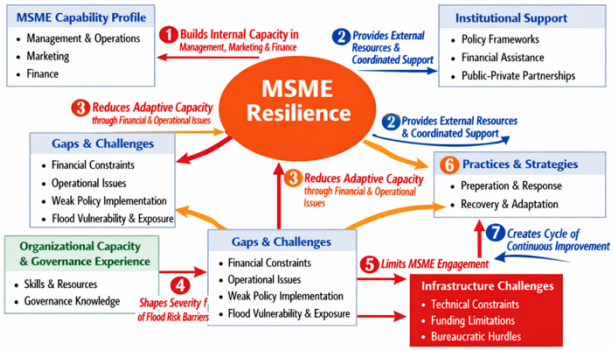

Figure 1. MSME Resilience Conceptual Framework

Figure 1 illustrates how internal capabilities, external support, and strategic practices interact to shape resilience among enterprises in flood-prone areas. Arrow 1 shows that MSME capability profiles include management, marketing, and finance. Shows how to build internal capacity to anticipate and recover from disruptions. Arrow 2 highlights how institutional support, including policies, financial aid, and partnerships, reinforces resilience by supplying coordinated resources, while arrow 3 indicates that financial constraints, operational issues, and flood vulnerability weaken resilience by reducing adaptive capacity. The arrow 4 hinted at organizational capacity and governance experience shape the severity of infrastructure challenges, while Arrow 5 shows that these challenges limit MSME participation in development processes. Arrow 6 suggests that preparedness, response, and adaptation strategies enhance resilience, and Arrow 7 completes the feedback loop, showing that resilient MSMEs refine their practices over time. It creates a cycle of continuous improvement. All of these relationships offer a structured lens for understanding how MSMEs in the Quinali "A" Watershed can strengthen their flood risk management and long-term sustainability.

MATERIALS AND METHODS

The study surveyed 95 formally registered MSMEs in flood-prone areas of Oas, Polangui, and Libon, selected from a population of 2,011 using Slovin's formula and guided by the USAID-DENR Vulnerability Assessment of the Quinali "A" Watershed. A descriptive-assessment approach was employed through surveys, interviews, and document reviews to evaluate MSMEs' flood risk management capabilities, preparedness strategies, government support, and resilience gaps.

For rubric structured analysis: Capability Profile (management, operations, marketing, finance), Practices/Strategies (preparation, response, recovery/adaption), Government Support (policy, financial aid, PPP initiatives), and Gaps and Challenges (operations, finance, policy, and market sustainability). Providing a comprehensive framework for identifying strengths, weaknesses, and actionable recommendations.

Table 1. Rubric for Analyzing MSMEs' Capability Profile on Flood Risk Management

Scale Range	Adjectival Description	Interpretation	Capability Classification
4.5 – 5.0	Very High Capability	MSME demonstrates outstanding and pro-active capability in managing flood risks, with well-established systems and practices	Strength
3.5 – 4.4	High Capability	MSME shows strong capability in flood risk management with few areas for enhancement	Strength
2.5 – 3.4	Moderate Capability	MSME has basic or average capability; needs further development to effectively manage flood risks	Weakness
1.5 – 2.4	Low Capability	MSME demonstrates limited capacity in handling flood-related risks, major improvements required	Weakness
1.0 – 1.4	Very Low Capability	MSME lacks essential capability in flood risk management; highly vulnerable and requires urgent support	Weakness

Requillas & Abante (2025)

The document review assessed MSMEs flood risk management practices across three phases: (i) preparation (risk assessment, asset protection, financial readiness, awareness), (ii) response (continuity, safety, crisis communication), and (iii) recovery/adaptation (financial recovery, rebuilding, market adaptation, long-term resilience), to determine the extent of adoption and effectiveness of strategies in sustaining enterprise resilience.

Table 2. Rubric for Assessing MSMEs' Flood Risk Management Practices/Strategies

Scale Range	Adjectival Description	Practice Classification	Interpretation
4.5 – 5.0	Fully Adopted	Best Practice	The practice is exemplary and fully integrated; serves as a model for others
3.5 – 4.4	Largely Adopted	Strong Practice	The practice is well established with consistent application and good results
2.4 – 3.4	Partially Adopted	Moderate Practice	The practice is applied inconsistently or in limited scope; needs strengthening
1.4 – 2.4	Minimally Adopted	Weak Practice	The practice is present but underdeveloped; requires significant improvement
1.0 – 1,4	Not Adopted	No Practice	The practice is not applied; urgent attention and action needed

Requillas & Abante (2025)

The document review assessed the extent of government support provided to MSMEs in flood-prone areas, focusing on policy and regulatory frameworks, financial assistance, and public-private partnership (PPP) initiatives, to determine how effectively these mechanisms enhance MSMEs' flood risk management capabilities and resilience.

Table 3. Rubric for Assessing Government Support to MSMEs to Enhance Flood Risk Management Capabilities

Response	Meaning	Implication	Recommended Action
Yes	MSMEs acknowledged receipt of government support/program	Indicates effective reach and awareness of support programs; MSMEs are potentially benefiting from such support	Sustain and possibly expand current programs; continue engaging MSMEs to improve resilience
No	MSMEs did not receive or not receiving government support	Implies lack access to or absence of government support; increases MSME vulnerability to flood risks	Improve outreach, identify service gaps, and develop inclusive programs for underserved MSMEs
Not Sure	MSMEs are unaware or unsure about government support programs	Reveals and information/awareness gap; suggests poor communication and insufficient dissemination of programs	Strengthen information dissemination efforts through local channels and partnerships with LGUs or NGOs

Requillas & Abante (2025)

The document review identified the key gaps and challenges MSMEs face in managing flood risks in Oas, Polangui, and Libon, spanning operations, finance, government support, and market sustainability, validated through stakeholder input to ensure the instrument's accuracy, relevance, and contextual fit.

Table 4. Rubric for Assessing Gaps and Challenges MSMEs Encountered in Managing Flood Risks

Scale Range	Adjectival Description	Implication	Recommended Action
4.5 – 5.0	Always	MSMEs consistently experience the gaps/challenges, persistent issues could severely affect FRM capabilities	Urgent and strategic government intervention needed; prioritize policy and resource allocation to address systematic issues
3.5 – 4.4	Often	MSMEs frequently experience gaps/challenges that regularly hamper FRM	Design targeted support programs and strengthen coordination with MSMEs to address recurring gaps
2.4 – 3.4	Sometimes	MSMEs intermittently experience gaps/challenges. Indicating a moderate level of concern	Monitor trends and implement preventive or support mechanisms to avoid escalation
1.4 – 2.4	Rarely	MSMEs frequently experience gaps/challenges implying a minor or emerging issue	Maintain current support while evaluating minor areas for improvement or risk of emerging challenges
1.0 – 1,4	Never	MSMEs do not experience gaps/challenges, effectively managed or not relevant	Sustain effective strategies and consider sharing best practices across other sectors or regions

Requillas & Abante (2025)

RESULTS AND DISCUSSION

The Integrated Logical Framework for MSME Capability Context in Flood Risk Management synthesizes government support mechanisms, recurring challenges, and best practices into a structured roadmap for resilience. This framework is anchored in the realities of MSMEs in the municipalities of Oas, Polangui, and Libon within the Quinali "A" Watershed, where enterprises face recurring flood risks that threaten both business continuity and community safety.

The Capability Context Model serves as both a diagnostic and developmental tool. It integrates management, operations, marketing, and finance strategies to strengthen enterprise continuity and mitigate flood impacts. Empirical findings reveal disparities in preparedness, financial constraints, and resilience variations, underscoring the need for a contextualized framework that aligns with local realities.

At the goal level, the Logical Framework emphasizes strengthening MSME resilience and adaptive capacity. Government support data shows moderate policy presence but weak financial assistance and PPP initiatives, while challenges highlight frequent disruptions in operations, finance, market sustainability, and policy implementation. These findings justify the framework's focus on proactive, structured interventions.

The MSME Capability profile identifies critical needs in Business Continuity Planning (BCP), DRRM, financial literacy, digital adaptation, and risk management. Addressing these gaps through training and capacity-building programs is essential to reducing vulnerabilities and enhancing preparedness.

The Best Practices Evaluation highlights strategies such as asset protection, adaptive operations, customer safety, and rebuilding mechanisms. Oas demonstrates stronger adoption of these practices, while Polangui and Libon lag behind, pointing to the need for institutionalizing and scaling successful approaches across municipalities.

The Gaps and Challenges Assessment integrates evidence that MSMEs "often" face financial constraints, weak government coordination, and market retention issues. These recurring barriers require targeted interventions, including localized financing schemes, strong PPP engagement, and inclusive policy-making.

The Capability Context Model Development combines MSME needs, best practices, and government/PPP support into a tailored framework. This ensures structured preparedness, response, and recovery strategies that evolve through stakeholder feedback.

The Implementation Framework emphasizes continuous updates, pilot testing, and collaboration to

sustain MSME empowerment. Finally, the Actionable Recommendations call for proactive policies, stable funding, and community engagement to institutionalize resilience and ensure long-term sustainability.

While the Logical Framework (LogFrame) provides structured analysis, measurable indicators, and policy alignment, the Schematic Framework offers a holistic visualization of MSME interactions within the flood risk management ecosystem. It maps stakeholders, processes, and resource flows, showing how MSMEs, government agencies, PPPs, and financial institutions collaborate to enhance preparedness. Together, these frameworks complement each other, one focusing on actionable strategies and monitoring, the other on systems thinking and visualization.

Table 5. Integrated Logical Framework for MSME Capability Context in Flood Risk Management in the 3rd District of Albay

Logical Framework Component	Findings		Proposed Development Management	Indicators/ Verification	Practical Implications
	Government Support	Challenges			
Goal	Moderate policy support; weak financial and PPP mechanisms	Frequent operational and financial disruptions	Strengthen MSME resilience and adaptive capacity	Stakeholder assessments, continuity evaluations	MSMEs must engage in resilience-building initiatives
MSME Capability Profile (Internal)	Limited training support from LGUs/DTI	Gaps in BCP, finance, and risk management	Training on BCP, DRRM, financial literacy, digital marketing, risk management	Surveys, interviews	MSMEs need active participation in capacity-building
Best Practices Evaluation	Policy frameworks partially institutionalized	Oas shows stronger adoption; Polangui/ Libon lag	Institutionalize asset protection, adaptive operations, rebuilding strategies	Case studies, performance reviews	Best practices can be scaled locally
Gaps and Challenges Assessment	Weak PPP and financial assistance	Challenges "Often" in finance, market retention, policy implementation	Target disruptions, financial losses, weak coordination, market retention	Focus groups, secondary data	Gaps are actionable with targeted interventions
Capability Context Model Development	Government support uneven across municipalities	Uneven resilience capacities	Tailored framework combining MSME needs, best practices, and Government / PPP support	Model refinement with stakeholder feedback	Framework must align with local realities
Implementation Framework	Support mechanism not consistently updated	Challenges recur frequently	Continuous updates, capacity-building, long-term empowerment	Pilot testing. collaboration	Requires sustained support from MSMEs, LGUs, partners
Actionable Recommendations	Weak visibility of Government programs	Market retention and finance issues persist	Proactive policies, stable funding, community engagement	Reports, dissemination	Recommendations feasible if resource-supported

Requillas & Abante (2025)

Table 5 provides a comprehensive roadmap for MSMEs in the 3rd District of Albay. It highlights that resilience can only be achieved through a balanced approach---strengthening internal capacities, institutionalizing best practices, and ensuring consistent government and community support. This integrated model not only enhances MSME flood preparedness but also contributes to broader DRRM strategies and sustainable local economic development.

CONCLUSION

In conclusion, the Integrated Logical Framework for MSME Capability Context in Flood Risk Management demonstrates that the resilience in flood-prone areas of the Quinali "A" Watershed can only be achieved through a balanced approach, strengthening internal capacities, institutionalizing best practices, and ensuring consistent government and community support. By combining diagnostic assessment with development strategies, the Capability Context Model provides MSMEs with structured preparedness, response, and recovery pathways that align with local realities. Ultimately, this integrated framework not only enhances enterprise continuity and adaptive capacity but also contributes to broader DRRM strategies and sustainable local economic development in Albay's 3rd District.

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