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A Multi-Hazard Approach to Disaster Risk Reduction for Typhoon-Induced Floods, Storm Surge, and Landslides in Barangay Hugom, San Juan, Batangas

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Abstract:

Barangay Hugom in the Municipality of San Juan, Batangas is increasingly exposed to multiple natural hazards, particularly typhoon-induced flooding, storm surge, and rainfall-induced landslides. Its coastline along Tayabas Bay and the upland and sloping terrain in its vicinity establish a multi-hazard risk setting, where hazards frequently coincide with each other during severe tropical cyclones. Repeated typhoons have displaced families, disrupted sources of income and basic services making a case for an integrative and community-based disaster risk reduction strategy. This paper presents a summary of a community-based disaster risk reduction and management (DRRM) action plan developed for Barangay Hugom using a multi-hazard approach. The plan is based on hazard profiling, vulnerability and capacity assessment and review of current institutional arrangements. It describes priority targets, objectives and subprojects under the four DRRM thematic areas: prevention and mitigation; preparedness; response; and rehabilitation and recovery. Accountability and capacity building are built in through monitoring and evaluation procedures. The action plan aims to strengthen local resilience, reduce disaster risks, and support sustainable development at the barangay level.

Keywords — **Multi-hazard risk, Community-based DRRM, Typhoon-induced flooding, Storm surge, Landslides**

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I. INTRODUCTION

San Juan, Batangas, is a municipality with a total land area of 27,340 hectares and a population of 114,068 according to the Philippine Statistics Authority (PSA) 2020 census. It consists of 42 barangays, 16 of which are located on the eastern part of the town, facing Tayabas Bay, along the 33-kilometer coastline. San Juan's topography is varied, with low, level parts along the eastern shore, slightly sloping terrain in the middle, and highest altitudes located in the western regions that border the towns of Rosario and Lobo [1].

Barangay Hugom is one of the westernmost barangays of San Juan. It has an area of 600 hectares, of which 20 hectares are used for agriculture; 400 hectares are forest, and 180 hectares are residential areas. The barangay is located 24 kilometers from the town or city center where the municipal hall is situated. As shown in Figure 1, to the east is Barangay Laiya Aplaya, to the west is Barangay Biga, Lobo, Batangas, to the north is Rosario, Batangas, and to the south is Mindoro. Based on the latest demographic records, Barangay Hugom has a total population of 2,057 individuals. These residents live in 523 households and in terms of family composition, Hugom has 548

families, indicating that some households accommodate more than one family [2].

It is a popular destination for ecotourism and resort development because of its beautiful beaches, natural forests, and rich biodiversity. It is situated at a convergence of environmental vulnerability and natural beauty, surrounded to the east by forested mountains and to the west by coastal waters. Agriculture, tourism, and small-scale fishing all contribute to the barangay's economy. Hugom is located in San Juan's Agri-Ecotourism/ nature tourism zone, which also includes Barangays Pinagbayanan, Catmon, Poctol, Imelda, Laiya Ibabao, Bulsa, and a portion of Barangays Janao-Janao, Libato, Sapangan, Pulangbato, and Quipot. This area offers beautiful views, mangroves or places to observe wildlife, as well as places for camping, climbing, trekking, diving, spelunking, and other activities [3]. Beach resorts and local businesses have been established as a result of the tourist inflow, boosting employment and revenue in the area. However, because the barangay is exposed to numerous natural hazards, these economic activities are frequently in jeopardy.

Geographically, Barangay Hugom is situated in a multi-hazard zone, making it highly vulnerable to various natural threats. Particularly during the southwest monsoon (habagat) season, which usually brings heavy rains and strong winds, it is especially vulnerable to typhoons and storm surges. Due to its coastal location, the barangay is also at risk of long-term effects of rising sea levels brought on by climate change as well as coastal erosion. Moreover, during heavy rainfall, the area's proximity to upland forested areas raises the risk of landslides and flash floods. A comprehensive and integrated multi-hazard disaster risk reduction and management (DRRM) approach that improves local preparedness, reduces vulnerabilities, and fosters long-term community resilience is critically important. According to the Participatory Community Risk Assessment (PCRA) of the Barangay Disaster Risk Reduction and Management Plan (2025–2027), storm surge, flooding, landslides, and fire are the barangay's top hazards [2].

To establish effective policies that enhance resilience to typhoons and their associated hazards, it is essential to understand how residents perceive disaster preparedness and awareness, as community members play a critical role in minimizing the impacts of natural hazards. This action plan assesses the current level of disaster risk awareness and preparedness among residents of Barangay Hugom, San Juan, Batangas.

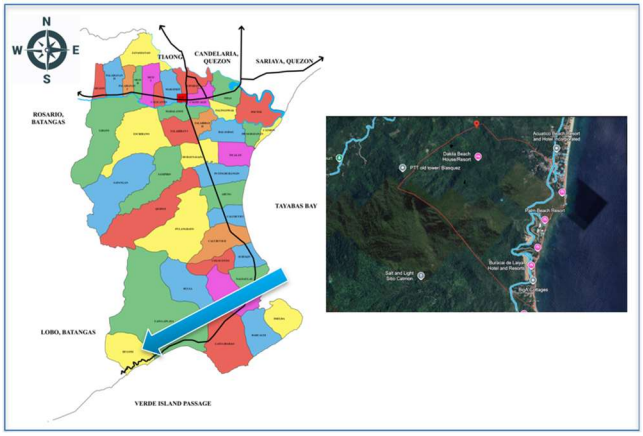

Fig. 1 Locational Map of Barangay Hugom, San Juan, Batangas

II. SITUATIONAL ANALYSIS

A. Global Analysis

Global climate variability has been significantly impacted by human activity-induced greenhouse gas emissions in recent decades, and the resulting climate change is expected to intensif y the factors that influence extreme events like tro pical cyclones (TCs) [4].

It has been increasingly recognized worldwide that climate change not only alters baseline conditions but also intensifies multi-hazard events and extreme weather, particularly those in coastal and tropical regions prone to typhoons, floods, and landslides. According to the Intergovernmental Panel on Climate Change (IPCC), rising global temperatures and warming oceans are causing tropical cyclones to intensify, rainfall to increase, and storm surge levels to rise [5]. Of the 7398 climate-related disasters that were documented, hydrological disasters were the most common, followed by meteorological and climatological disasters. The average numbers of affected people and damage per million population showed statistically significant variations [6].

Between 1970 and 2019, 45% of all recorded fatalities and 50% of all disasters were caused by water-related hazards. More people are affected by floods than by any other hazard. Almost 200 million

people live in flood-prone coastal areas worldwide. According to recent data, up to 35–40% of weather-related disasters are caused by floods. Compared to the two earlier decades, the number of flood-related disasters has increased by 134% since 2000. Globally, the number of people at risk of flooding has also increased steadily, rising from 28.1 million in 1970 to 35.1 million in 2020, a 24.9% increase. At present, flooding causes an average of USD 388 billion in losses every year worldwide. Climate change is expected to cause this to increase significantly in the near future. The average annual losses to infrastructure caused by riverine flooding are expected to rise by 5% to 13% by 2050, amounting to USD 407 to 439 billion in losses annually [7].

Around the world, storm surges have caused extensive damage. Super Typhoon Yolanda, which hit the Philippines in 2013, was the worst typhoon in the previous 30 years. With estimated damages of USD 864 million, it resulted in the reported deaths of 6293 people, 28 689 injuries, and 1061 missing persons [8]. In August 2017, Hurricane Harvey hit Texas, killing about 100 people and causing more than USD 125 billion in damages [9].

Another common worldwide hazard that causes significant death tolls and socioeconomic damage is landslides. Mountainous regions in tropical and temperate regions account for the majority of anthropogenic (44.1%) and natural (69.3%) landslides. These regions also have the highest rates of casualties per group (66.7% and 43.0%, respectively) [10]. South Asia is the most affected region, primarily due to the summer monsoon, while East Asia is primarily affected by landfalling tropical cyclones and a monsoonal climate, according to a closer examination of deadly landslide hotspots. While not attributing them to a particular climatic regime, Petley DN (2010) identifies Southeast Asia (primarily the Philippines and Indonesia) as a hotspot for landslide fatalities [11]. According to one estimate, landslides brought on by heavy rain kill about 4,600 people annually [12].

As a result, many countries have implemented multi-hazard and integrated disaster risk reduction (DRR) frameworks. On March 18, 2015, the Third UN World Conference on Disaster Risk Reduction in Sendai, Japan, adopted the Sendai Framework for Disaster Risk Reduction 2015–2030. Over the following 15 years, it seeks to significantly lower the risk of disasters and the losses they cause to people's lives, livelihoods, and health, as well as to the economic, physical, social, cultural, and environmental assets of individuals, organizations, communities, and nations. [13].

Similarly, ecosystem-based adaptation, or EbA, is becoming increasingly recognized worldwide as a natural way to lower the risk of hazards. Protecting communities from the effects of climate change includes the conservation, restoration, and sustainable management of ecosystems. Examples include reforestation to stabilize water cycles and mangrove restoration to lessen the effects of storm surges [14].

International developments in disaster risk reduction and in climate change highlight the need of establishing a proactive, universal, and climate-resilient multi-hazard strategy. Therefore, local disaster risk reduction efforts can be strengthened by learning from global experiences and by adopting international standards.

B. Local Analysis

The Philippines is one of the countries that is most vulnerable to the effects of climate change. Among the 193 countries included in the 2022 World Risk Index, it was ranked as having the highest disaster risk, along with Indonesia and India [15]. According to some estimates, 74 percent of the Philippines' population and 60 percent of its land area are vulnerable to a variety of natural disasters, such as earthquakes, tsunamis, landslides, cyclones, droughts, and floods. There have been 565 such disasters in the nation since 1990, resulting in $23 billion in damages and 70,000 fatalities [16]. The Philippines is particularly vulnerable to flash floods because of its geographic location and status as an archipelagic nation. According to the ASEAN Disaster Reduction Center (ADRC), the country, which is located along the Pacific typhoon belt, averages 20 typhoons annually, five of which are usually deemed destructive [17]. Because of its location and complicated physical environment, the Philippines is also susceptible to other hazards such as flooding,

droughts, storm surges, landslides, tsunamis, and sea level rise [18].

In the Philippines' history, flash floods have resulted in large losses in terms of people, property, and economic activity. The Cordillera Administrative Region (CAR), Regions I, III, IV-A, and others have been determined as the most flood-prone areas [19]. In 2009, Typhoon Ketsana (Ondoy) flooded 80% of Metro Manila with an unprecedented 455 mm of rain in a single day, impacting millions of people [20].

Similarly, Typhoon Haiyan, that landfall on November 8, 2013, in the Philippines' eastern Visayas region, may have been the strongest tropical cyclone ever recorded, reaching sustained speeds of up to 195 mph (315 km/h). At least 6,000 people died, over a million homes were damaged, and 16 million people were impacted. With its more than 7,000 islands and with long bare coastlines due to mangrove destructions, the Philippines is vulnerable to storm surges. While the loss and damage from typhoon Haiyan were mainly due to tsunami-like storm surge with a height of at least 5 meters, those from other typhoons were caused by tremendous floods and landslides from heavy and continuous rainfall particularly in areas with uncovered forest [21].

Throughout the year, there are 5 or 6 cyclonic storms, which reportedly contributed to flooding in low-lying areas of San Juan. Typhoon Ofel struck Batangas Province on October 25, 2012, and had a significant impact on several barangays in San Juan, including Hugom. It damaged 632 families or 3,046 people, left 8 families homeless, forced 72 families, or 344 people, to evacuate, and resulted to 5 casualties. Typhoon Glenda brought strong winds and heavy rainfall to this municipality on July 16, 2014. About 9,000 households were severely impacted by the most destructive typhoon to ever hit San Juan. Severe flooding was experienced in different barangays, either upland or low-lying areas [1].

Typhoon Ruby hit Batangas province on December 8, 2014, and San Juan experienced intense rains, along with partial damage to houses, crops, and infrastructure. Two powerful tropical storms (Rolly on November 1 and Ulysess on November 11) and one super typhoon (Quinta on October 25) frequently hit the municipality in 2020. A total of 792 families were reported to have been displaced: 586 during Typhoon Quinta, 119 during Typhoon Rolly, and 87 during Typhoon Ulysess. A total of 66 completely damaged houses were reported, along with 1,402 partially damaged houses: 935 in Quinta, 454 in Rolly, and 13 in Ulysess[1].

Over the coastal waters near San Juan, Batangas, on October 29, 2022, STS Paeng made landfall. Due to the municipality's catch-basin-like geographic location, Severe Tropical Storm Paeng brought an excessive amount of water to the Municipality of San Juan, Batangas, causing massive flooding in several barangays. Also, Typhoon Ewiniar, also referred to as Aghon locally, threatened the Municipality of San Juan on May 29, 2024, with its strong winds, torrential rains, and subsequent urban flooding. At least three people were injured in the storm, which also forced many families to evacuate to safer areas and left hundreds of homes without electricity. Fisheries and agriculture suffered significant financial losses totaling Php 85,915,825.00 [1].

San Juan is vulnerable to a number of natural and man-made hazards because of its topography and geographic location. The main risks caused by tropical cyclones with strong winds and heavy, prolonged rainfall are flooding and landslides. Using participatory governance, the local government of San Juan implemented strategies for managing flood and landslide risks that included both structural (building a box culvert, opening canals, building bridge, de-clogging, dredging canals, early warning device installation, slope protection, and riprapping of Lawaye River wall) and non-structural (Execution of Contingency plans, Capability building, IEC, tree planting) measures [1].

III. METHODOLOGIES

This study used both exploratory and descriptive research methods. This research design was chosen because it meets the objectives of the study which is to gain insights on the awareness and resilience of the members of the community on DRRM practices

and on how to respond to effects of multi-hazards such as typhoons, floods, storm surges and landslides.

The research's exploratory phase used qualitative method to acquire detailed information about Barangay Hugom's present disaster risk reduction and management (DRRM) practices. This includes methods of gathering information about the community's perceptions, local strategies and responses to such multi-hazard events. The data were collected through Key Informant Interviews (KIIs) with barangay officials, DRRM focal persons, health workers, and other relevant individuals engaged in local disaster management. Focus Group Discussions (FGDs) was also initiated with locals, including women, youth, elderly people, and fishermen, to learn more about their experiences with previous disasters and social factors affecting response and preparation. This also helps identify the resident's knowledge and cultural practices in order to aid in the development of community-based and multi-hazard response disaster risk reduction management strategies.

On the other hand, the descriptive research design used a quantitative data were utilized to assess the current level of disaster risk awareness and readiness of the residents of Barangay Hugom. To gather the relevant information regarding their disaster awareness, early warning system access, prior disaster experiences, evacuation preparedness measures, a representative sample of residents were given a structured survey questionnaire. The sampling was based on the barangay's population.

IV. RESULTS AND DISCUSSION

The respondents of this study are the residents of Barangay Hugom, San Juan, Batangas, who are potentially exposed to multiple natural hazards such as typhoon-induced, floods, storm surges and landslides. The barangay is composed of seven (7) sitios namely, Sitio Centro, Sitio Lukeya, Sitio Camposite, Sitio Hulo Albon, Sitio Bunga, Sitio Biga and Sitio Catmon.

A total of 66 respondents were chosen to proportionally represent the seven (7) sitios, guaranteeing that all were adequately represented and ensuring that their perception, past experiences and involvement during disasters were included. The respondents compromise of adult aged 18 years and above who have lived in Hugom for at least 3 years. This criterion ensures that participants have sufficient exposure and familiarity with the hazards impacting the barangay.

Stratified random sampling method was used in this study, wherein the population of 2,057 residents was divided into 7 sitios. To ensure equitable representation, respondents were randomly chosen from each sitio in proportion to the size of the community. This method provides a comprehensive understanding of the disaster risks and community preparedness levels throughout the barangay.

Respondents were given a structured survey questionnaire to assess their demographics, awareness, risk perception, preparedness and response, previous experiences with disasters and their capacity and involvement in disaster risk reduction programs. Their insights form the foundation for assessing current levels of disaster preparedness and determining the gaps and opportunities for a multi-hazard approach to risk reduction in Barangay Hugom.

A. Data Analysis

Descriptive statistical methods were used to analyze the data for the close ended questions, and the findings were displayed in tables. The weighted mean was calculated for each indicator to determine the overall degree of agreement among respondents. Each item was given a numerical value between 1 and 5, where 1 represented "Strongly Disagree" and 5 represented "Strongly Agree." A verbal interpretation scale was then used to evaluate the calculated means and categorize the results as Strongly Disagree, Disagree, Neutral, Agree, or Strongly Agree. This method offered a brief overview of respondents' attitudes and views toward risk mitigation and disaster preparedness, which was used to identify strengths, gaps, and potential areas for improvement in the community's disaster management efforts.

On the other hand, content analysis was used to analyze responses to the open-ended question. Content analysis can be both qualitative (focuses on interpreting meaning and context) and quantitative (focuses on counting and measuring). Analyzing the conceptual linkages and meaning of words and concepts allowed for the simultaneous drawing of qualitative conclusions.

B. Profile of the Respondents

TABLE I
PROFILE OF THE RESPONDENTS

Sitio	**Frequency**	**Percentage (%)**
Catmon	3	4.67%
Biga	10	15.02%
Centro	7	11.28%
Lukeya	8	11.82%
Camposite	17	26.02%
Hulo Bunga	13	19.11%
Hulo Albon	8	12.10%
Total	66	100.00%
Age Group	**Frequency**	**Percentage (%)**
18–25 years old	4	6.06%
26–35 years old	13	19.70%
36–45 years old	17	25.76%
46–55 years old	18	27.27%
56 years old and above	14	21.21%
Total	66	100.00%
Sex	**Frequency**	**Percentage (%)**
Male	20	30.30%
Female	46	69.70%
Total	66	100.00%
Years of Residency	**Frequency**	**Percentage (%)**
Less than 10 years	3	4.55%
10–19 years	7	10.61%
20–29 years	16	24.24%
30–39 years	16	24.24%
40–49 years	10	15.15%
50 years and above	14	21.21%
Total	66	100.00%
Occupation	**Frequency**	**Percentage (%)**
Banker	1	1.52%
Barangay Official	4	6.06%
Barangay Staff (BNS, BHW, Secretary)	3	4.55%
Business Owner	1	1.52%
Carpenter	1	1.52%
Construction Worker	2	3.03%
Driver	2	3.03%
Fisherman/woman	8	12.12%
Housekeeper	1	1.52%
Housewife	9	13.64%
Laundrywoman	2	3.03%
Lifeguard	2	3.03%
Pensioner	4	6.06%
Resort Staff	9	13.64%
Therapist	10	15.15%
Unemployed	1	1.52%
Vendor	6	9.09%
Total	66	100.00%

Table 1 presents the demographic profile of survey respondents for the multi-hazard action plan. The section explores key factors such as age, sex, occupation, and place of residence in an effort to provide a comprehensive picture of the population at risk. These insights are important for developing targeted and effective interventions.

C. Awareness and Disaster Prevention

TABLE IIIII
RESPONDENTS' LEVEL OF AWARENESS AND KNOWLEDGE ON DISASTER PREVENTION

Statement	**Mean Score**	**Verbal Interpretation**
1. I am aware that Barangay Hugom is vulnerable to typhoons.	3.75	Agree
2. I believe floods, storm surge, and landslides are serious threats to our community.	4.35	Strongly Agree
3. I have enough knowledge on how to reduce or prevent the impacts of disasters.	3.87	Agree
4. There are community programs, such as tree planting to help prevent landslides.	4.22	Strongly Agree
5. Our barangay has protective infrastructures such as drainage systems and flood barriers.	2.46	Disagree
6. I know how to participate in the barangay's disaster risk reduction plans and activities.	4.11	Agree

Based on the results presented in Table 2, the respondents generally demonstrated a high level of awareness and understanding of disaster risks affecting Barangay Hugom. The majority of respondents scored between "strongly agree" and "agree" on the Likert scale, according to the weighted mean, which ranges from 3.75 to 4.35 overall.

D. Disaster Preparedness

TABLE IVVVI
RESPONDENTS' LEVEL OF PREPAREDNESS FOR DISASTERS

Statement	Mean Score	Verbal Interpretation
7. My family has a disaster emergency kit or "Go Bag."	3.91	Agree
8. I know where the evacuation centers are.	4.48	Strongly Agree
9. We have a communication plan in case of separation during a disaster.	4.18	Agree
10. I follow weather updates from PAGASA or local authorities.	4.55	Strongly Agree
11. I know how to interpret and respond to early warning signs and alerts in our area.	4.28	Strongly Agree
12. I have participated in disaster drills in our barangay.	4.09	Agree

The results in Table 3 show that residents of Barangay Hugom generally demonstrate a high level of preparedness and readiness in responding to disasters. The responses reveal that most families are aware of the necessary steps to take before and during emergencies. However, strengthening household preparedness measures, such as ensuring every family maintains a "Go Bag" and enhancing participation in regular drills, will further improve the barangay's overall resilience.

E. Respondents' Experience and Disaster Response

TABLE IV
ASSESSMENT OF RESPONDENTS' EXPERIENCE AND DISASTER RESPONSE

Statement	Mean Score	Verbal Interpretation
13. I'm willing to volunteer during disasters.	4.35	Strongly Agree
14. There were sufficient facilities and assistance at the evacuation center during previous disasters.	4.28	Strongly Agree
15. The last disaster response was effective.	4.38	Strongly Agree
16. Local officials gave clear instructions before/during disasters.	4.59	Strongly Agree
17. Based on my experience, the warning time before a disaster was sufficient.	4.49	Strongly Agree
18. Our community works together during disasters.	4.54	Strongly Agree
19. The barangay has enough resources and equipment.	4.31	Strongly Agree
20. I trust the barangay disaster response team.	4.55	Strongly Agree

The results presented in Table 4 indicates that the respondents have a high level of positive experience and confidence in their community's disaster response system, as reflected by the overall mean scores ranging from 4.28 to 4.59, all verbally interpreted as Strongly Agree. This suggests that the community members are aware of the effectiveness of their local disaster response efforts and are actively involved during disasters.

F. Recovery and Rehabilitation

TABLE V
RECOVERY AND REHABILITATION

Statement	Mean Score	Verbal Interpretation
21. After a disaster, the barangay or LGU quickly provided food, water, and medicine.	4.22	Strongly Agree
22. Livelihood assistance was provided to those affected by the disaster.	1.94	Disagree
23. Financial or material aid from the government and NGOs reached the truly affected families.	4.49	Strongly Agree
24. After the disaster, activities for psychosocial or mental health support were conducted for residents.	2	Disagree

25. The barangay learned from past disasters and used the experience to improve DRRM plans.	4.38	Strongly Agree

The respondents' evaluation of Barangay Hugom's post-disaster recovery and rehabilitation efforts is shown in Table 5. The results show that Barangay Hugom performs well in both institutional learning and immediate recovery, but needs improvement in livelihood restoration and psychosocial rehabilitation to guarantee comprehensive community recovery.

G. Respondents Needs and Recommendations

TABLE VI
NEEDS AND RECOMMENDATIONS

Statement	Mean Score	Verbal Interpretation
26. We need more disaster education and training.	4.26	Strongly Agree
27. We need more early warning systems like sirens and signs.	4.05	Agree
28. We need better infrastructure to prevent disasters.	4.19	Agree
29. There should be regular drills for typhoons and landslides.	4.65	Strongly Agree

Table 6 presents the respondents' views on the community's needs and recommendations to further strengthen disaster preparedness and resilience. The highest mean score was recorded for the statement "There should be regular drills for typhoons and landslides" (4.65), which received a Strongly Agree interpretation. The need for ongoing learning to improve knowledge and preparedness during calamities is also acknowledged by respondents, who strongly agree that more disaster education and training are required (Mean = 4.26).

Respondents also agree that improvements are still necessary in several areas, such as establishing more early warning systems like sirens and signs (Mean = 4.05) and developing better infrastructure to prevent disasters (Mean = 4.19). These responses indicate that even if the barangay has existing preparedness measures, there is still a need for further investment in structural and technological systems that can provide timely alerts and minimize physical damage.

H. Respondents' Suggestions for Strengthening Community Preparedness

Based on the responses gathered from different sitios, most residents believe that strengthening training and capacity-building programs is important to improving community preparedness. Many respondents stated the importance of regular disaster awareness seminars, training in basic life support, and educational activities in every sitio to ensure that all residents are equipped with knowledge and practical skills.

Several participants also mentioned the need for early warning systems in remote areas and better communication during emergencies to ensure that all households receive timely information. Meanwhile, others suggested environmental initiatives such as tree planting and drainage clean-up drives to prevent flooding and landslides, showing an understanding of how environmental care supports disaster resilience. Other suggestions included building or improving water drainage systems and ensuring maintenance after typhoons to avoid stagnant water and flooding.

A significant number of responses, especially from Sitio Biga, addressed financial limitations and suggested additional funding and resources for disaster preparedness, relief operations, and barangay improvement. Some also mentioned the importance of having emergency kits, medicine supplies, and emergency lights ready at home.

Some respondents expressed satisfaction with current efforts by stating that the barangay's disaster preparedness programs are already adequate. However, the overall response points to the desire for continuous education, stronger funding, and improved facilities to make Barangay Hugom more resilient against future disasters.

V. SWOC ANALYSIS

Strengths

- Barangay Hugom residents have strong disaster awareness developed due to years of experience with typhoons and hazards
- Community members are able to recognize early warning signs and respond quickly with minimal external assistance
- An updated BDRRM Plan provides clear guidance on preparedness, evacuation, and emergency response
- Availability of records on vulnerable groups supports targeted evacuation and assistance
- Presence of essential emergency equipment such as a generator, radios, megaphone, and ambulance
- Active and committed BDRRMC supported by responsive barangay officials
- Regular drills, information campaigns, and collaboration with the MDRRMO strengthen preparedness

Weaknesses

- Barangay Hugom's geographic location makes the barangay highly exposed to flooding, storm surges, and landslides
- Inadequate drainage and poorly maintained canals worsen flooding during heavy rains
- Absence of hazard detection devices such as landslide and storm surge sensors limits early warning and monitoring capacity
- Current warning methods are ineffective in distant sitios
- Limited budget and technical support restrict access to modern equipment and training
- No fully trained emergency response team
- Infrequent skills training for responders and volunteers reduces efficiency during actual emergencies
- Lack of livelihood support slows recovery for disaster-affected families
- No formal post-disaster psychosocial or mental health services
- Financial constraints weaken overall preparedness and capacity-building efforts

Opportunities

- Establishment and training of community-based Emergency Response Team
- Expanded use of social media and mobile platforms for faster information sharing
- Integration of GIS-based hazard mapping and digital risk profiling tools for hazard identification and planning
- Improved evacuation planning through GIS-based risk assessment
- Growth of ecotourism as a way to promote environmental protection and resilience
- Conservation of natural barriers (mangroves, forests) to reduce hazard impacts
- Stronger partnerships with San Juan MDRRMO and national agencies for funding and technical support

Challenges

- More frequent and severe typhoons caused by changing climate conditions
- Environmental degradation increasing risks of landslides, erosion, and storm surges
- Possible delays in emergency assistance due to remoteness, damaged roads, and communication issues
- Remote location reduces access to hospitals and emergency services
- Unregulated tourism development in hazard-prone areas
- Construction activities disrupting natural drainage systems
- Disaster risk reduction competing with other socioeconomic priorities in budgeting and planning

VI. PESTEL ANALYSIS

Political: Disaster risk reduction in Barangay Hugom is shaped by both national policies and local governance structures. The Philippine DRRM Act of 2010 (RA 10121) requires the institutionalization of local disaster management bodies, which is reflected in Hugom's Barangay Disaster Risk

Reduction and Management Council (BDRRMC). This council is mandated to develop preparedness programs, conduct evacuation drills, and coordinate with the Municipal DRRMO of San Juan. The San Juan LDRRM Plan (2026–2028) emphasizes bottom-up planning, where barangay inputs are consolidated into municipal strategies. This ensures that localized vulnerabilities such as storm surges, flooding, and landslides are directly addressed at higher policy levels.

Economic: The local economy of Barangay Hugom relies primarily on fishing, agriculture, and coastal tourism. These sectors, however, are among the most vulnerable to typhoons and related hazards.

Tourism has a major impact on the local economy of Barangay Hugom, where 56 active beach resorts are important sources of employment and income for locals. Since many households in Hugom rely on tourism-related activities, the industry is essential to the stability of the local economy. As noted in the Barangay Hugom BDRRM Plan and the San Juan LDRRM Plan, a large percentage of Hugom's economic assets are located in storm surge and flood-prone areas due to the concentration of these 56 resorts along the coastline.

Social: Hugom's population of approximately 2,057 people demonstrates strong community solidarity, especially during disaster events. The BDRRM Plan highlights bayanihan as a key factor in local response, with residents working together in evacuation, relief distribution, and recovery. However, social vulnerabilities remain. Children, the elderly, women, and persons with disabilities often experience heightened risks due to limited mobility, income dependency, or access to information. Ensuring inclusivity in disaster planning is therefore critical. Both the barangay and municipal plans highlight the importance of sectoral representation in Disaster Risk Reduction and Management Councils, ensuring that all groups have a voice in planning and decision-making. Information, Education, and Communication (IEC) campaigns, school-based preparedness programs, and gender-sensitive evacuation centers are practical ways to build resilience at the social level.

Technological: Technology plays a crucial role in strengthening Hugom's preparedness for typhoon-induced floods, storm surges, and landslides. The barangay currently makes use of basic early warning systems, radios, and text messaging, but the BDRRM Plan records instances of communication failures during typhoons, highlighting a gap in reliability.

Environmental: Hugom's geographical location places it at the intersection of multiple hazards; its coastline is prone to storm surges and flooding, while its upland areas are highly susceptible to rain-induced landslides. The BDRRM Plan identifies several sitios affected by recurrent flooding, while the LDRRM Plan underscores Hugom's high susceptibility to storm surges and landslides due to steep slopes and coastal exposure. Environmental degradation, such as deforestation, improper waste management, and unregulated construction, further intensifies the risks.

Legal: The legal framework guiding disaster management in Barangay Hugom is anchored in national policies, most notably RA 10121 (Philippine DRRM Act of 2010) and RA 9729 (Climate Change Act of 2009). At the barangay level, ordinances operationalize these mandates by enforcing evacuation drills, waste management rules, and restrictions on settlement in hazard-prone areas. The BDRRM Plan stresses the importance of strengthening these ordinances and ensuring compliance through community participation.

VII. COMPREHENSIVE ACTION PLAN

Goal 1: To minimize the potential loss of lives, properties, and livelihoods

Objective 1.1: To conduct regular multi-hazard risk assessments and mapping to identify flood-prone, landslide-susceptible, and storm surge–exposed areas within the barangay and strengthen policy enforcement on zoning, construction safety standards, and the prohibition of settlement in high-risk areas.

1.1.1 Conduct GIS Training for Barangay-Level

1.1.2 Conduct a barangay hazard and risk assessment and community consultations to validate and finalize the hazard maps covering all sitios.

1.1.3 Update and enforce local zoning and safety ordinances based on risk data.

Objective 1.2: To integrate climate change adaptation and environmental protection practices, including coastal resource management, tree planting, and waste segregation.

1.2.1 Coordinate with DENR, MENRO, and PPA

1.2.2 Organize tree planting and mangrove reforestation activities in coastal and upland areas

1.2.3 Implement a barangay waste segregation and recycling system.

1.2.4 Conduct community education and awareness drives on environmental protection and climate adaptation.

Objective 1.3: To construct an effective drainage system and flood control structures in flood-prone areas of the barangay, and regular cleaning and maintenance of existing drainage facilities to prevent water stagnation and flooding.

1.3.1 Construct barangay drainage systems and flood barriers in identified flood-prone areas.

1.3.2 Conduct regular canal and drainage cleaning and maintenance

1.3.3 Organize quarterly community clean-up drives.

Goal 2: To enhance the readiness and adaptive capacity of the community

Objective 2.1: To organize and support the Barangay Disaster Risk Reduction and Management Committee (BDRRMC) and its response teams through continuous training and drills.

2.1.1 Conduct a 3-day community-based disaster risk reduction and management training

2.1.2 Conduct of contingency planning for landslide, storm surge and flooding (5 days)

2.1.3 Implement regular landslide, storm surge and flood simulation drills in schools and communities.

Objective 2.2: To create and regularly update the Barangay Evacuation and Contingency Plans, integrating communication networks and multi-hazard early warning systems

2.2.1 Update the Evacuation Plans based on hazard and vulnerability assessments.

2.2.2 Install and maintain advanced early warning systems to enhance and augment conventional sirens and megaphones, such as solar-powered alarm towers and community-based radio communication systems.

2.2.3 Strengthen the lines of communication between emergency responders, sitio representatives, and barangay leaders through two-way radios.

Objective 2.3: To promote household-level preparedness through information, education, and communication (IEC) campaigns on emergency response and safety measures.

2.3.1 Conduct community IEC campaigns on disaster preparedness and safety.

2.3.2 Installation of signages for EWS

2.3.3 Launch a “Go Bag” campaign promoting household emergency kit preparation.

Goal 3: To ensure a prompt, efficient, and well-coordinated response system

Objective 3.1: To establish and strengthen the Barangay Emergency Response Team (BERT) through training, equipment provision, and coordination with the Municipal DRRMO.

3.1.1 Conduct BERT orientation and capacity-building training

3.1.2 Procure basic emergency and rescue equipment (first aid kits, stretchers, flashlights)

3.1.3 Establish coordination and communication protocol between BERT and MDRRMO

Objective 3.2: To ensure the establishment and maintenance of safe and accessible evacuation

centers equipped with basic services and relief supplies.

3.2.1 Assess and identify safe evacuation centers and alternative sites

3.2.2 Repair and upgrade existing evacuation facilities

3.2.3 Stocks and maintain emergency supplies

Objective 3.3: To carry out post-disaster evaluation and documentation in order to guide mobilization of resources and implementation of early recovery measures.

3.3.1 Conduct rapid disaster assessment and damage reporting

3.3.2 Hold debriefing and after-action review with affected families and responders

3.3.3 Develop and update Barangay Early Recovery and Rehabilitation Plan

Goal 4: To restore and improve the living conditions, livelihoods, and public services of the affected residents

Objective 4.1: To repair and rehabilitate damaged houses, facilities, and infrastructure using resilient design and construction standards in the context of "Build Back Better".

4.1.1 Conduct post-disaster infrastructure assessment and prioritization

4.1.2 Repair damaged barangay facilities (barangay hall, health center, waiting sheds) using resilient construction materials

4.1.3 Provide technical assistance for housing repair for affected families

Objective 4.2: To provide livelihood restoration and skills training programs for affected families, particularly those dependent on fishing, farming, and tourism-related work.

4.2.1 Conduct skills training and livelihood workshops (e.g., fish net repair, handicrafts, eco-tourism services, small-scale food processing)

4.2.2 Implement Cash-for-Work program focused on community rehabilitation (debris clearing, canal cleaning, replanting)

4.2.3 Provide livelihood starter kits (e.g., fishing tools, seedlings)

Objective 4.3: To provide activities for psychosocial or mental health support for residents affected after the disaster.

4.3.1 Conduct of Mental Health and Psychosocial Support (MHPSS) Activities

VIII. MONITORING AND EVALUATION

This section focuses on monitoring and evaluation of Projects, Programs, and Activities (PPAs) of the action plan "A Multi-Hazard Approach to Disaster Risk Reduction for Typhoon-Induced Floods, Storm Surge, and Landslides in Barangay Hugom, San Juan, Batangas ". Monitoring and evaluation serve as a tool in in monitoring, promoting transparency, and facilitating improvement in the different aspects of disaster risk reduction in the community of Hugom. Monitoring will be carried out through the submission of reports by the Barangay Disaster Risk Reduction and Management Committee in coordination with the written reports in the form of activity logs, attendance sheets, minutes of the meetings, after-action reports, and photos taken from the simulation drills. Monitoring would also include visits to the area to check the status and effectiveness of early warning systems, evacuation points, and critical structures. Coordination meetings between barangay officials, the Municipal Disaster Risk Reduction and Management Office, and relevant national government agencies will supplement these monitoring efforts. The monitoring would be followed by the evaluation, which would determine the achievement or accomplishment of the objectives aimed in the action plan by comparing the targeted objectives to the actual outcome, reviewing the changes in the level of public awareness, readiness, and response, and by checking the performance in the simulation drills and actual disaster risk reduction actions.

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