



Disaster Preparedness Index of Households and Selected Local Government Units in Laguna, Philippines

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Abstract

Strengthening disaster preparedness and resilience at all levels of society in the country remains to be a major challenge. In line with this, the study was conducted to determine the level of disaster preparedness index (DPI) of the selected flood-prone households, barangays, and municipalities in the Province of Laguna using the asset or capital-based approach. A total of 194 household respondents were randomly selected in Brgy. Santisima Cruz, Santa Cruz; Brgy. Concepcion, Lumban; and Brgy. Nanguma, Mabitac. Key informant interviews, focus group discussions, and household surveys were conducted to collect primary data. Computed weights were derived through analytic hierarchy process (AHP) to come-up with the DPI at the household, barangay, and municipal levels. Capital-based assessment of the disaster preparedness revealed that at the household level, 51% of the respondents in the three sites had high DPI, 34% had moderate DPI, and 15% had low DPI. All the three barangays had moderate DPI while all the three municipalities had high DPI. Overall assessment shows that cascading disaster preparedness programs from municipal to barangay, and eventually to household is not fully implemented. Identified areas with low DPI should be given the highest priority and resources for disaster preparation.

Keywords: analytic hierarchical process, capital, disaster preparedness, disaster preparedness index, household level, local government

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Highlights

- Disaster preparedness index at the household, barangay and municipal levels are at the moderate level, signifying moderate compliance to the minimum requirements of RA 10121, and other related regulations.
- This paper proposes a disaster preparedness rating instrument at the municipal, barangay and household levels that can be adopted by Local Government Units (LGUs) in conducting similar assessment in their own communities.
- Cascading disaster programs from municipal to barangay, and eventually to households is not fully implemented.
- There is a need to modify the process of Disaster Risk Reduction and Management (DRRM) fund allocation, which should be based on the need for disaster preparation and not solely on income of the LGU.

Introduction

The Philippines is one among the top five countries most frequently hit by natural disasters (Guha-Sapir *et al.*, 2016). Allen (2006) reported that the Philippines is likely to experience an increase in the frequency and severity of typhoons and flash-flooding incidents. In particular, Laguna is in the list of top 10 provinces in the country considered most vulnerable to climate change hazards, including typhoons and floods (Arias *et al.*, 2014). Hazard is a dangerous condition or event, that threat or have the potential for causing injury to life or damage to property of the environment (Khan *et al.*, 2008). The most significant natural hazards for Laguna, in terms of frequency and proportion of households affected, were typhoons and floods (Arias *et al.*, 2014).

Flooding remains one of the most devastating hazards to affect communities globally (Brody *et al.*, 2008). The impact of frequent and widespread damages of flooding severely affects humans (Jongman *et al.*, 2015). Floods caused cancellation and disruption of regular classes, physical damage to schools, adverse effects on teachers at home and in school, and attendance and learning performance among students (Ardales *et al.*, 2016). The effects raised several concerns about preparedness.

Preparedness is associated positively with previous experiences in disasters (Gillespie and Streeter, 1987). In line with this, the level of disaster resilience of the communities, disaster preparedness and response capabilities of the LGUs was greatly tested when super typhoon Yolanda (international name *Haiyan*) struck the central Philippines on November 8, 2013. It was

reported to be one of the strongest typhoons to strike land on record (Lum & Margesson, 2014).

Bosher *et al.* (2009) underscored that despite the detrimental impacts of disasters, there is still insufficient evidence that key stakeholders are playing a proactive role in mitigating disasters in the built environment and hazard awareness is absent from their decision-making process. With the present condition and direction of the disaster preparedness of local government units (municipality and barangays) and households, there are identified gaps in the implementation of DRRM programs, projects, and activities at all levels, hence, this study.

Materials and Methods

The Study Area

The study was conducted in three municipalities of Laguna province, namely: Santa Cruz, Lumban, and Mabitac (Figure 1). These three municipalities, respectively representing 1st income class, 3rd income class and 5th income class, were purposively chosen as the research locale due to their exposure to high susceptibility to flooding. Three barangays, one for each municipality, were subjectively chosen from the list or information provided by the Municipal Disaster Risk Reduction Management Office (MDRRMO). These barangays (Table 1) were the most adversely affected by the occurrence of historical flooding brought by TS Santi (*Nari*) and Ondoy (*Ketsana*).

Selection of Respondents

Stratified random sampling method was employed in the selection of respondents in each barangay (i.e., stratum). Given the total household (N) of 3,770, the sample size ($n=194$) was determined using Slovin's formula (Oliver & Dizon, 2016; Talukder *et al.*, 2016) (Equation 1) with a precision level (e) of 7%. The sample of households was randomly selected from the list of households provided by LGUs (Santisima Cruz, Santa Cruz = 112; Concepcion, Lumban = 46; Nanguma, Mabitac = 36).

$$n = \frac{N}{1 + Ne} \quad (\text{Equation 1})$$

where N = total household population, n = sample size and e = 7% precision level.

Data Collection

A pre-focus group discussion (pre-FGD) was conducted in the initial phase of study to determine if the initial indicators of disaster preparedness assessment being used by Department of the Interior and Local Government

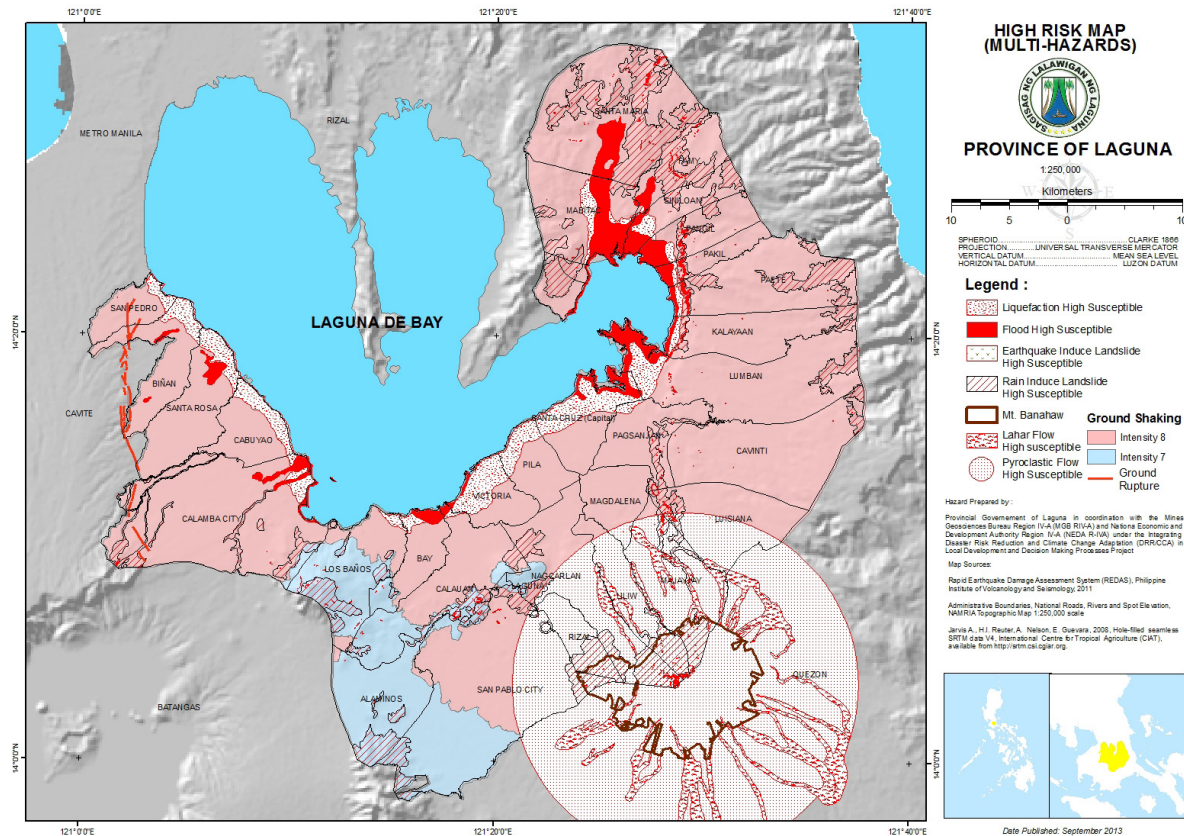


Figure 1. High risk map (multi-hazards) and the selected flood-prone municipalities in the Province of Laguna (Province of Laguna, 2013)

Table 1. Selected municipalities and barangays in Laguna

MUNICIPALITY	INCOME CLASS	SELECTED BARANGAY	DESCRIPTION
Santa Cruz	1 st	Santisima Cruz	Located along the riverbanks of Santa Cruz river and coastal areas of Laguna de Bay. Most severely affected barangay by TS Santi and TS Ondoy with the highest number of families or number of persons and damaged houses. The barangay is considered high in flood risk with the highest percentage (44.62%) of affected area.
Lumban	3 rd	Concepcion	Located near Pagsanjan-Lumban River and Laguna de Bay. Barangay Concepcion had the greatest number of damaged houses and affected population when flash flood happened during TS Santi and TS Ondoy. The barangays' topography is low and community population therefore are highly vulnerable to flood.
Mabitac	5 th	Nanguma	Categorized as vulnerable to very extreme flooding (Pati <i>et al.</i> , 2014).

(DILG) are still relevant. Selected members of Municipal Disaster Risk Reduction and Management Councils (MDRRMCs) and Barangay Disaster Risk Reduction and Management Councils (BDRRMCs) were the participants in the pre-FGD. Pre-FGD confirmed that all the indicators used in disaster preparedness assessment were relevant. The study used both primary and secondary data. Primary data were collected through FGDs, key informant interviews (KIIs) and household surveys in 2019. FGD using discussion guide was conducted to determine and describe the assets of the respondents at the municipal, barangay, and household levels in the selected flood-prone areas; to know and validate the relevant indicators of disaster preparedness in LGUs and households; and evaluate the subsequent disaster preparedness implementation in the municipalities, barangays, and households. The FGD participants were purposively selected, the members of MDRRMC at the municipal level, members of BDRRMC for the barangay and key household members representing different sectors for the household level. A total of nine FGDs were conducted, corresponding to the three selected municipalities, three selected barangays and another three groups for the household level affected by flooding. The qualitative data gathered from the FGDs were used to enhance the survey instrument. Indicators from the review of literature and assessment tool of DILG were confirmed through the narratives of the participants. The meanings of DPI from participants were identified.

In the study, deriving the weights for the disaster preparedness indicators and sub-indicators was determined through analytic hierarchy process calculation technique (Saaty, 1977; 1990). The data for AHP were gathered from the experts through KIIs and FGDs (Luu *et al.*, 2018; Buot, 2016). Experts were tapped to determine how they perceive the relative importance of the indicators at the municipal, barangay, and household levels. Moreover, the disaster preparedness assessment tool for municipality and barangay was administered through KII. MDRRM Officers and Punong Barangays of the selected LGUs were the sources of information.

The conduct of household survey interview was coordinated with the respective Punong Barangays and Secretaries in the selected barangays. Experienced enumerators (field interviewers) were recruited and trained on the field administration of the pre-tested questionnaire. The survey questionnaire was prepared for household level which was pre-tested and considered further refinement. Appropriate modifications were made based on the outcome of the pre-testing activity. Reliability test was conducted using Cronbach's alpha (α) in SPSS (Gliem & Gliem, 2003) using Equation 2. This is to measure the consistency in response patterns for a set of items, particularly in measuring trust.

$$\alpha = \frac{k_{ij}}{1 + (k - 1)_{ij}} \quad (\text{Equation 2})$$

where:

k = number of survey items associated with the concept

r_{ij} = the average correlation among the items

Following the decision rule: $\alpha > 0.65$ is acceptable, reliability test score for measuring trust was 0.655, therefore was acceptable.

Secondary data were gathered from the DILG, DRRM offices, Planning Offices and concerned offices of Sangguniang Barangays to supplement the information that were gathered through FGDs, KIIs and household surveys. Data on LGU-based information on DRRM projects, programs and activities implemented in years 2016 and 2017 focused on disaster preparedness were collected. In particular, the LDRRM Plan, LDRRMF allocation and utilization reports, trainings and activities conducted related to disaster preparedness. In addition, the annual investment plans (AIPs), comprehensive land use plan (CLUP), contingency plan on flooding, Local Climate Change Action Plan (LCCAP) in the municipality, barangay readiness profile and other related reports and materials.

Data Analysis

Descriptive statistics was used in analyzing the data. Figure 2 shows the complete process of developing the DPI. AHP, a decomposition multiple-attribute decision-making (MADM) method developed by Saaty (1977, 1990) was used in determining judgements based on hierarchy, pairwise comparisons, judgment scales, and allocation of criteria weights (Buot, 2016; Kinsa & Jeaser, 2017; Luu *et al.*, 2018) of the identified disaster preparedness indicators of households, barangays, and municipalities. Consistency ratio (CR) was computed to verify the obtained weights and aggregation method was considered. Based on these results, the DPI was established. The formula for general index (P_{ix}) (Simpson, 2006) is given in Equation 3 while the DPI for household, barangay, and municipality is shown in Equations 4, 5 and 6.

$$P_{ix} = (w_1 FM_1 + w_2 FM_2 + \dots + w_n FM_n) \quad (\text{Equation 3})$$

where:

P_i = disaster preparedness index

subscript x = location of community (Municipality/ Barangay/ Household)

w_n = weight for a given measure

FM_n = functional measure/indicator

n = number of measures

Household

$$DPI = (w_1A_1 + w_2Con_2 + w_3Com_3) \quad (\text{Equation 4})$$

where:

w_1, w_2, w_3 = weights of given indicators/measures
 A_1 = awareness
 Con_2 = connectedness
 Com_3 = competency

LS_1 = Leadership Structure
 RAM_2 = Risk Assessment and Mapping
 C_3 = Competency
 A_4 = Awareness
 CP_5 = Contingency Planning

MunicipalityBarangay

$$DPI = (w_1LS_1 + w_2RAM_2 + w_3C_3 + w_4A_4 + w_5CP_5)$$

(Equation 6)

$$DPI = (w_1LS_1 + w_2RAM_2 + w_3C_3 + w_4A_4 + w_5CP_5) \quad (\text{Equation 5})$$

where:

w_1, w_2, w_3, w_4, w_5 = weights of given indicators/measures

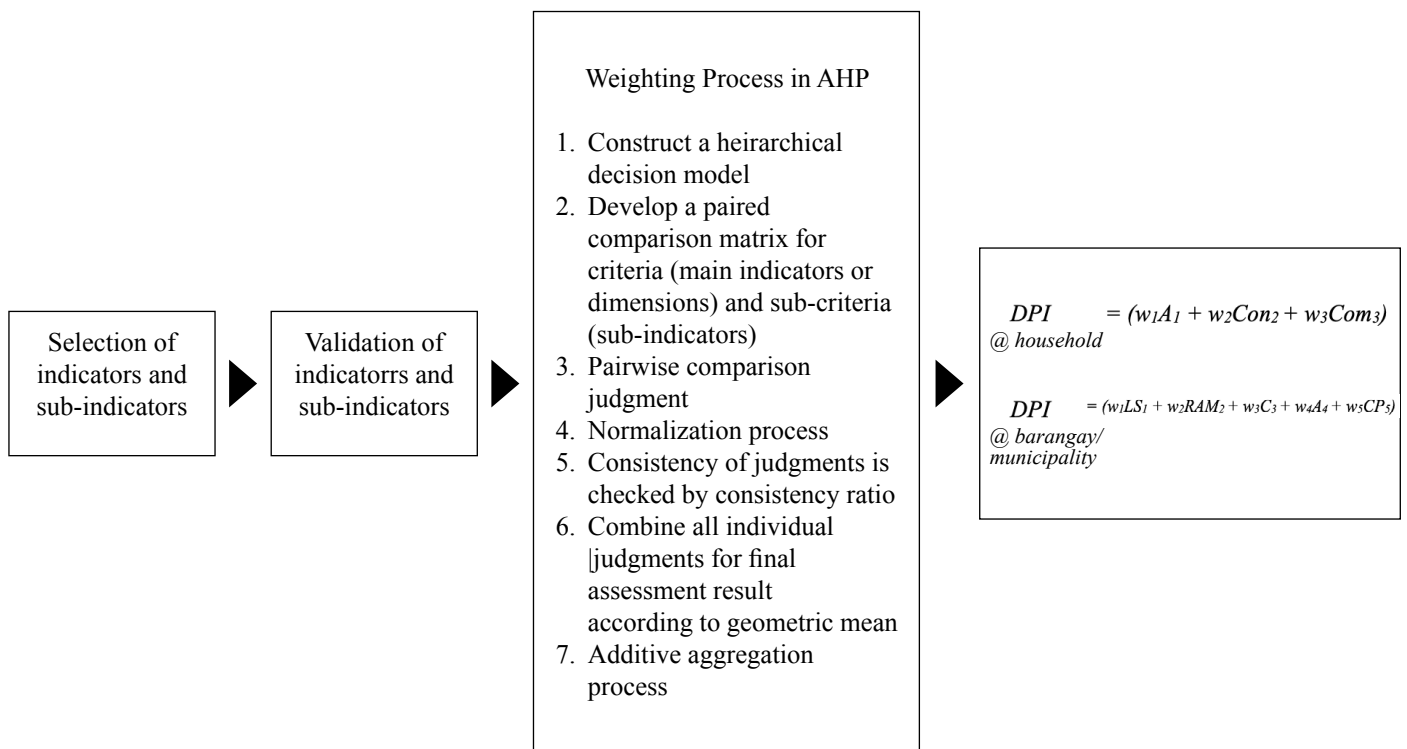


Figure 2. Process in the establishment of the disaster preparedness index

The DP score/value was compared to the interpretation of values in Table 2.

Table 2. Level of disaster preparedness index, corresponding value and description

LEVEL OF DPI	P _{ix} VALUE ^a	DESCRIPTION
LOW	0.00 – 0.50	With low or non-compliance to the minimum requirements of the RA 10121 and other related regulations.
MODERATE	0.51 – 0.79	With moderate compliance to the minimum requirements of the RA 10121 and other related regulations.
HIGH	0.80- 1.00	With high compliance to the minimum requirements of the RA 10121 and other related regulations.

Source: Arias *et al.* (2014)

Results and Discussion

Majority (74%) of the respondents were males and belonged to the middle age group (31-50 years old) with an average age of 44 years old; more than half (56%) were married; and have an average household size of five. Regarding *human capital* at the household level, majority of households lacked disaster preparedness orientation/training, such that only 27% experienced disaster preparedness orientation/training. At the barangay level, all Barangay Disaster Risk Reduction and Management Committees (BDRRMCs) were organized but only Emergency Response Teams (ERTs) of Brgy. Santisima Cruz were trained of the evacuation and community drills. At the municipal level, all the Municipal Disaster Risk Reduction and Management Councils (MDRRMCs) were organized - ERTs were organized, equipped, and trained with basic emergency and rescue trainings.

For the *natural capital* at the household level, about 1,048 m was the average distance of Laguna de Bay from the households' dwelling units while 124 m was the average distance of nearest river from the household's dwelling units. In this regard, households living close to rivers and lake are highly vulnerable to flooding and therefore, have to undergo disaster preparedness training with simulation exercises. At the barangay and municipal levels, Laguna de Bay provides fishing

grounds to fisherfolks, who should be prioritized for future training to prevent casualties from possible disaster or emergencies caused by flooding.

As to *financial capital* at the household level, about 43% of the respondents belonged to low-income earners (i.e., PhP 1,000 – 5,000 monthly income bracket) while 18% belong to medium income earners (i.e., PhP 5,001-9,999). The first semester per capita poverty threshold in Laguna was PhP 10,701 in 2015 and PhP 11,471 in 2018, which is higher than the average for the Philippines at PhP 10,481 (PSA, 2019). Poor populations according to Covington and Simpson (2006) typically live-in areas that are more prone to disaster. This was so because the socio-economic status creates vulnerability in the poor faction of the population, manifested in several ways, namely: poor populations do not have the financial support that the wealthy do, making it more difficult for them to prepare for, endure and recover from disaster; the availability of cash and savings, as well as access to entitlements such as insurance, stocks, and bonds, is often reserved for those who can afford them. At the barangay level, Brgy. Santisima Cruz had the highest LDRRMF allocation, followed by Brgy. Concepcion and by Brgy. Nanguma. The 70% LDRRMF allotted for disaster preparedness and mitigation in Brgy. Concepcion was consumed 100% and had a 46% utilization from Quick Response Fund (the 30% LDRRMF), which supposedly are kept unutilized since no calamity came during the period. This shows that the budget plan for 2017 was not implemented well. Most of the LGUs were not able to fully utilize LDRRMF as reported in the Annual Financial Report for 2016 and 2017 signifying those programs/projects/activities were not fully implemented as stipulated in the plans. At the municipal level, Santa Cruz had the highest LDRRMF allocation, followed by Lumban, and by Mabitac. In 2016, Mabitac had the highest 70% LDRRMF utilization. In 2017, it was Santa Cruz which had the highest LDRRMF utilization among the three municipalities. Moreover, there was inequality in the availability of financial resources among LGUs. The three barangays had difficulty in investing for disaster preparedness due to limited budget. More financial support is needed and relevant for disaster preparedness programs and proper monitoring of LDRRMF utilization.

For *physical capital* at the household level, majority of the respondent's houses in the three sites were accessible by road wherein about 41% of the houses were made with mixed but predominantly light materials and 15% were made with mixed but predominantly salvaged materials. Majority of the respondents had cell phone, television, and radio. More than half of the household's main source of drinking water was mineral and *poso* for domestic purposes. Majority of the households had available electricity provided by an electric company. At the barangay level, all barangays have motorized vehicle but lack water rescue kit and personal protective gear. Only Brgy. Nanguma had first aid kit. For evacuation

centers, Mabitac had the highest number and capacity of evacuation centers. At the municipal level, all the three municipalities had the basic equipment needed during emergency or disaster. Municipalities had more complete disaster search and rescue equipment than barangays. According to Mayunga (2007), insufficiency of physical infrastructure or critical facilities generally may have direct negative impact on community capacity to cope with disaster. In this regard, barangays will need more resources to support the medical and health facilities and shelter space. Barangays have to operationalize the evacuation center management system in coordination with the municipal government including the system for registration and information guide for evacuees.

For *social capital*, at the household level, only 31% of the respondents were members of organizations. Relatively high percentage (66%) were able to attend in the barangay assembly and more than half (55%) of the respondents participated in disaster preparedness information campaign. Only 31% of the respondents were members of organizations. Respondents in Brgy. Nanguma were the most active respondents while respondents in Brgy. Concepcion were the least active in terms of participating in barangay activities related to disaster preparedness when asked to rate the level of their participation. Level of agreement regarding household's trust to neighbors, local government, NGOs/CSOs, national government, schools, and health workers varied ranging from 2.28 (disagree) to 4.61 (strongly agree), where rating is 1=strongly disagree, 2=disagree; 3=neither agree or disagree; 4= agree; 5= strongly agree. At the household level, there is a need to assist the people to increase their level of membership to organizations also to build networks, households had very low membership to organizations and membership to other institutions providing social services. There is also a need to increase the level of trust of people to neighbors, local government, national government, churches, schools, and health workers. Barangays and municipalities had strong partnership with partner associations which were committed to extend help during calamities. However, there is a need to establish Memorandum of Agreement or Memorandum of Understanding (MOA/MOU) with basic suppliers which municipal government may extend their assistance in this area. Barangays and municipalities have to invite and encourage more people to participate in barangay activities relative to increasing disaster preparedness.

Meanwhile, the DPI was assessed using the computed weights of indicators through AHP with acceptable consistency ratio (0.10 or lower). The DPI at the household level was measured using the three main indicators categorized into capital with corresponding equal weights: namely, awareness (*human capital*) (0.33), connectedness (*social capital*) (0.33) and competency (mostly *human capital*, with *social and physical capitals*) (0.33) (Table 3). The sub-indicators per main indicator categorized into capitals had each

corresponding computed weight as well. Figure 3 shows the DPI ratings of the respondents in Brgy. Santisima Cruz, Brgy. Concepcion and Brgy. Nanguma. In all three sites, 51% of the respondents had high DPI, 34% had moderate DPI, and 15% had low DPI. Low DPI signifies that low or non-compliance to the minimum requirements of the RA 10121 and other related regulations. Details of ratings for the sub-indicators at the household level is given in Annex A.

Table 3. Average ratings of main indicators at the household level in selected barangays.

MAIN INDICATORS	WEIGHT	AVERAGE RATING			
		BRGY. SANTISIMA CRUZ	BRGY. CONCEPCION	BRGY. NANGUMA	ALL SITES
Awareness	0.33	0.24	0.23	0.28	0.24
Connectedness	0.33	0.27	0.22	0.28	0.26
Competency	0.33	0.23	0.18	0.29	0.23

When the respondents were asked if they are ready for disaster (flooding), result shows that almost all (95%) perceived of their readiness with a common reason of they are already used to it. However, the results of the study show variations in their level of disaster preparedness (Figure 3).

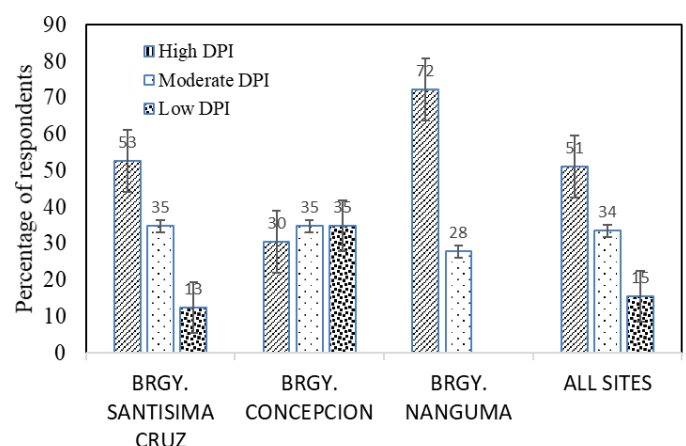


Figure 3. Disaster preparedness index ratings at the household level in selected barangays

The DPI at barangay and municipal levels was measured using the following main indicators with corresponding computed weight; namely, leadership structure (*human capital*) (0.21); risk assessment and mapping (*human capital*) (0.23); technical competency (*human capital*) (0.12); awareness (*human capital*) (0.23); and contingency planning (*human capital*) (0.22). All the three barangays had moderate DPI, which signifies moderate compliance to the minimum requirements of the RA 10121 and other related regulations (Table 4). Details of ratings for the sub-indicators at the barangay level is given in Annex B.

Shown in Table 5 are the DPI of the three municipalities wherein all got a high level of DPI indicating high compliance to the minimum requirements of the RA 10121 and other related laws. The Municipality of Mabitac had the highest DP score of 0.88, followed by the Municipality of Lumban (0.87), and by the Municipality of Santa Cruz (0.86). Of the five main indicators, leadership structure (*human capital*) had the highest rating in Santa Cruz (0.21) and Mabitac (0.21) while risk assessment and mapping (*human capital*) had the highest rating in Lumban (0.23). Details of ratings for the sub-indicators of the three municipalities is given in Annex C.

Table 4. Main indicators and disaster preparedness index ratings at the barangay level.

MAIN INDICATORS	WEIGHT	RATING		
		BRGY. SANTISIMA CRUZ	BRGY. CONCEPCION	BRGY. NANGUMA
Leadership Structure (<i>Human capital</i>)	0.21	0.14	0.10	0.14
Risk Assessment and Mapping (<i>Human capital</i>)	0.23	0.19	0.22	0.19
Competency (<i>Human capital</i>)	0.12	0.10	0.00	0.07
Awareness (<i>Human capital</i>)	0.23	0.16	0.09	0.09
Contingency Planning (<i>Human, Financial, Physical, Social capitals</i>)	0.22	0.13	0.11	0.15
DP score (P_{ix} value)		0.72	0.52	0.64
Level of DPI		Moderate	Moderate	Moderate

Table 5. Main indicators and disaster preparedness index ratings at the municipal level.

MAIN INDICATORS	WEIGHT	RATING		
		SANTA CRUZ	LUMBAN	MABITAC
Leadership Structure (<i>Human capital</i>)	0.21	0.21	0.19	0.21
Risk Assessment and Mapping (<i>Human capital</i>)	0.23	0.18	0.23	0.19
Competency (<i>Human capital</i>)	0.12	0.12	0.12	0.12
Awareness (<i>Human capital</i>)	0.23	0.17	0.18	0.19
Contingency Planning (<i>Human, Financial, Physical, Social capitals</i>)	0.22	0.18	0.16	0.18
DP score (P_{ix} value)		0.86	0.87	0.88
Level of DPI		High	High	High

Conclusions and Recommendations

In the assessment of disaster preparedness at the household level, there were variations in the level of disaster preparedness. Communities characterized by higher levels of *physical*, *human*, and *social capital* in disaster risk management are better prepared and more effective responders to disaster (Buckland & Rahman, 1999). Those households with high DPI have to sustain high awareness (human capital) to hazards, the threats and possible effects/impacts of hazards, and awareness to information related to disaster preparedness. Also, households have to keep the high level of connectedness (*social capital*) to neighbors, local governments, media, schools, churches and workplace and even high level of competency. Those households with moderate and low DPI have to be proactive in enhancing the level of disaster preparedness, emergency *balde* or *e-balde* complete with equipment (physical capital). At the barangay level, all the three barangays had moderate DPI level implying that the probability of enduring the potential effects of disaster is also moderate. The three barangays have to examine the factors and strive to increase their level of disaster preparedness. At the municipal level, the DPI of the three municipalities were high implying that municipalities are ready enough and have high chance or probability to endure the pressures and potential effects of disaster. The municipalities have to sustain the good practices of disaster preparedness.

For national government and policymakers, there is a need to consider modifying the process of determining the total LDRRMF which should be based on need for disaster preparation and not on the income level of the LGU. Households, barangays, and municipalities that are highly exposed to risks and vulnerable to disaster would require higher LDRRMF allocation. When DPI level is moderate or low, this needs more resources to increase DPI and therefore increase the safety of the family and community. A nationwide mapping of DPI as one of the monitoring metrics is highly recommended.

For the local governments and policymakers, there is a need to determine disaster preparedness using the DPI to arrive at an evidence-based policy regarding prioritization of investments in community capitals aimed at community development. It is recommended that they employ the developed disaster preparedness assessment tool at the household level, barangay and municipal levels used in this study.

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DILG Laguna and LDRRM Offices; and respondents of this study, who contributed their efforts in providing imperative information. May the fruit of everyone's effort in this study reproduce for the good and safety of the communities of Santa Cruz, Lumban, and Mabitac.

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APPENDIX A
Indicators used for estimation of household adaptive capacity

SUB-INDICATORS	WEIGHT	AVERAGE RATING			
		BRGY. SANTISIMA CRUZ	BRGY. CONCEPCION	BRGY. NANGUMA	ALL SITES
Awareness (A)					
Awareness of hazards (i.e. flood and typhoon) (A ₁) (<i>Human capital</i>)	0.25	0.13	0.14	0.22	0.15
Awareness of threats and possible effects/impacts of hazards (i.e. flood and typhoon) (A ₂) (<i>Human capital</i>)	0.37	0.30	0.27	0.25	0.28
Evacuation awareness (presence of evacuation guide) (A ₃) (<i>Human capital</i>)	0.37	0.28	0.26	0.37	0.30
Connectedness (Con)					
Neighborhood (Con ₁) (<i>Social capital</i>)	0.17	0.12	0.05	0.15	0.11
Local government (Con ₂) (<i>Social capital</i>)	0.17	0.15	0.13	0.17	0.15
Churches (Con ₃) (<i>Social capital</i>)	0.17	0.11	0.08	0.11	0.10
Media (Con ₄) (<i>Social capital</i>)	0.17	0.17	0.17	0.17	0.17
Workplace (Con ₅) (<i>Social capital</i>)	0.17	0.13	0.09	0.11	0.12
Schools (Con ₆) (<i>Social capital</i>)	0.17	0.14	0.12	0.13	0.13
Competency (Com)					
Regular Family Discussion about disaster preparedness (twice or thrice monthly) (Com ₁) (<i>Human capital</i>)	0.10	0.01	0.05	0.04	0.02
Explain to HH members the cause and effects/impacts of a disaster (Com ₂) (<i>Human capital</i>)	0.10	0.08	0.07	0.10	0.08
Teach household members specially children the steps how to evacuate (Com ₃) (<i>Human capital</i>)	0.10	0.08	0.07	0.10	0.08
Know the safe place or route to evacuation centers (Com ₄) (<i>Human capital</i>)	0.10	0.08	0.09	0.09	0.08
With one or two designated meeting place/s in times of emergency or disasters (Com ₅) (<i>Human capital</i>)	0.10	0.09	0.04	0.10	0.08
Know local officials/offices to be called in times of emergency/disaster and emergency numbers (Com ₆) (<i>Human capital</i>)	0.10	0.09	0.04	0.10	0.08
With emergency balde or <i>e-balde</i> with complete equipment (Com ₇) (<i>Physical capital</i>)	0.10	0.01	0.02	0.05	0.02
Practice how to evacuate through participation in any evacuation and community drills (Com ₈) (<i>Social capital</i>)	0.10	0.07	0.03	0.09	0.06

APPENDIX A (cont.)

Indicators used for estimation of household adaptive capacity

SUB-INDICATORS	WEIGHT	AVERAGE RATING			
		BRGY. SANTISIMA CRUZ	BRGY. CONCEPCION	BRGY. NANGUMA	ALL SITES
Participation in setting-up of early warning signal in the barangay/municipality (Com ₉) (<i>Social capital</i>)	0.10	0.08	0.03	0.09	0.07
Monitor radio, television, and social networking sites related to weather forecasts and other emergency concerns (Com ₁₀) (<i>Human capital</i>)	0.10	0.10	0.10	0.10	0.10

APPENDIX B

Sub-indicator ratings at the barangay level

SUB-INDICATORS	WEIGHT	AVERAGE RATING		
		BRGY. SANTISIMA CRUZ	BRGY. CONCEPCION	BRGY. NANGUMA
Leadership Structure (LS)				
BDRRM Committee (LS ₁) (<i>Human capital</i>)	0.20	0.10	0.10	0.10
BDRR Management (LS ₂) (<i>Human capital</i>)	0.27	0.27	0.07	0.27
Incident Command System (LS ₃) (<i>Human capital</i>)	0.22	0.00	0.00	0.00
Disaster Operations or Emergency Center or Operation Center (LS ₄) (<i>Human capital</i>)	0.31	0.31	0.31	0.31
Risk Assessment and Mapping (RAM)				
Identified sitios/purok/families prone to flood (RAM ₁) (<i>Human capital</i>)	0.14	0.14	0.14	0.14
Identified population at risk (RAM ₂) (<i>Human capital</i>)	0.14	0.14	0.14	0.14
Identified vulnerable or marginalized individuals (RAM ₄) (<i>Human capital</i>)	0.14	0.11	0.11	0.11
Identified community assets susceptible to damaging effects of flood (RAM ₅) (<i>Human capital</i>)	0.14	0.14	0.14	0.14
Availability of hazard maps (RAM ₆) (<i>Human capital</i>)	0.14	0.00	0.00	0.00
Availability of risk and/or vulnerability maps (RAM ₇) (<i>Human capital</i>)	0.14	0.00	0.14	0.00
Conduct of risk and/or vulnerability assessment (<i>Human capital</i>)	0.14	0.14	0.14	0.14

APPENDIX B (cont.)
Sub-indicator ratings at the barangay level

SUB-INDICATORS	WEIGHT	AVERAGE RATING		
		BRGY. SANTISIMA CRUZ	BRGY. CONCEPCION	BRGY. NANGUMA
Competency (C)				
Organized search and rescue team or emergency response teams (ERTs) (C ₁) (<i>Human capital</i>)	0.25	0.25	0.00	0.25
Equipped and trained rescue team or ERTs (C ₂) (<i>Human capital</i>)	0.25	0.13	0.00	0.06
Conduct of simulation exercises (C ₃) (<i>Human capital</i>)	0.25	0.25	0.00	0.25
Presence of Guide for ERTs specifying protocols and responsibilities (C ₄) (<i>Human capital</i>)	0.25	0.25	0.00	0.25
Awareness (A)				
Awareness of hazards (i.e. flood and typhoon) (A ₁) (<i>Human capital</i>)	0.20	0.13	0.13	0.14
Awareness of the threats and possible effects/impacts of hazards (typhoon and flooding) (A ₂) (<i>Human capital</i>)	0.40	0.18	0.26	0.26
Evacuation awareness (presence of evacuation guides) (A ₃) (<i>Human capital</i>)	0.40	0.40	0.00	0.00
Contingency Planning (CP)				
Availability of plans that integrate DRR-CCA related measures (CP ₁) (<i>Human capital</i>)	0.17	0.11	0.11	0.13
LDRRMF allocation (CP ₂) (<i>Financial capital</i>)	0.17	0.11	0.11	0.11
Utilization of 70% LDRRM Fund (CP ₃) (<i>Financial capital</i>)	0.17	0.06	0.00	0.09
Early warning system (CP ₄) (<i>Financial capital</i>)	0.17	0.17	0.17	0.17
Evacuation center mgt system (CP ₅) (<i>Financial capital</i>)	0.17	0.07	0.07	0.07
Systems of prepositioning of goods and services (CP ₆)				
a. Mobilization and management of volunteer groups (Social capital)	0.17	0.05	0.04	0.09
b. Relief operations (stockpiling) (Physical capital)				
c. MOA with suppliers (i.e. supermarket, pharmacy, medical groups) (Social capital)				
d. Security services (Human capital)				
e. Disaster equipment (Physical capital)				

APPENDIX C
Sub-indicator ratings at the municipal level

SUB-INDICATORS	WEIGHT	AVERAGE RATING		
		SANTA CRUZ	LUMBAN	MABITAC
Leadership Structure (LS)				
MDRRM Council (LS ₁) (<i>Human capital</i>)	0.21	0.21	0.11	0.21
MDRR Management (LS ₂) (<i>Human capital</i>)	0.26	0.26	0.26	0.26
Incident Command System (LS ₃) (<i>Human capital</i>)	0.23	0.23	0.23	0.23
Operation Center (OPCEN) (LS ₄) (<i>Human capital</i>)	0.29	0.29	0.29	0.29
Risk Assessment and Mapping (RAM)				
Identified flood prone barangays (RAM ₁) (<i>Human capital</i>)	0.14	0.14	0.14	0.14
Identified population at risk (RAM ₂) (<i>Human capital</i>)	0.14	0.14	0.14	0.14
Identified vulnerable or marginalized individuals (RAM ₃) (<i>Human capital</i>)	0.14	0.09	0.11	0.11
Identified community assets susceptible to damaging effects of flood (RAM ₄) (<i>Human capital</i>)	0.14	0.14	0.14	0.14
Availability of hazard maps (RAM ₅) (<i>Human capital</i>)	0.14	0.14	0.14	0.14
Availability of risk and/or vulnerability maps (RAM ₆) (<i>Human capital</i>)	0.14	0.00	0.14	0.00
Conduct of risk and/or vulnerability assessment (RAM ₇) (<i>Human capital</i>)	0.14	0.14	0.14	0.14
Competency (C)				
Organized search and rescue team or emergency response teams (ERTs) (C ₁) (<i>Human capital</i>)	0.25	0.25	0.25	0.25
Equipped and trained rescue teams (C ₂) (<i>Human capital</i>)	0.25	0.25	0.25	0.25
Conduct of simulation exercises (C ₃) (<i>Human capital</i>)	0.25	0.25	0.25	0.25
Presence of Guide for ERTs specifying protocols and responsibilities (C ₄) (<i>Human capital</i>)	0.25	0.25	0.25	0.25
Awareness (A)				
Awareness to hazards (typhoon and flooding) (A ₁) (<i>Human capital</i>)	0.31	0.25	0.22	0.25
Awareness to the threats and possible effects/impacts of hazards (typhoon and flooding) (A ₂) (<i>Human capital</i>)	0.44	0.24	0.34	0.34
Evacuation awareness (presence of evacuation guides) (A ₃) (<i>Human capital</i>)	0.25	0.25	0.25	0.25

APPENDIX C (cont.)
Sub-indicator ratings at the municipal level

SUB-INDICATORS	WEIGHT	AVERAGE RATING		
		SANTA CRUZ	LUMBAN	MABITAC
Contingency Planning (CP)				
Availability of plans that integrate DRR-CCA related measures (CP ₁) (<i>Human capital</i>)	0.19	0.15	0.08	0.12
LDRRMF allocation (CP ₂) (<i>Human capital</i>)	0.19	0.19	0.19	0.19
Utilization of 70% LDRRM Fund (CP ₃) (<i>Human capital</i>)	0.19	0.14	0.07	0.14
Early warning system (CP ₄) (<i>Human capital</i>)	0.17	0.17	0.17	0.17
Evacuation center mgt system (CP ₅) (<i>Human capital</i>)	0.14	0.11	0.11	0.11
Systems of prepositioning of goods and services (CP ₆)				
a. Mobilization and management of volunteer groups (<i>Social capital</i>)				
b. Relief operations (stockpiling) (<i>Physical capital</i>)				
c. MOA with suppliers (i.e. supermarket, pharmacy, medical groups) (<i>Social capital</i>)	0.12	0.06	0.10	0.08
d. Security services (<i>Human capital</i>)				
e. Disaster equipment (<i>Physical capital</i>)				