

# Framework Of Disaster Preparedness Among Coastal Communities In Davao City, Philippines

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## Abstract

This study aimed to develop framework of disaster preparedness in communities of coastal barangay's in Davao City, Philippines. Responses from Barangay Disaster Risk Reduction and Management Committee (BDRRMC) members and residents were processed and analyzed through exploratory factor analysis.

Results of the study showed that those coastal Barangay which have sufficient Internal Revenue Allotment (IRA) and have frequently encountered coastal disasters are more prepared and they seriously implement disaster risk reduction programming. Technically, majority of the respondents were capacitated through series of skills trainings. Furthermore, the study was able to generate five dimensions of disaster preparedness among coastal communities of Davao City namely; awareness and knowledge on disaster risk reduction protocol, structural adaptation, governance, household disaster mitigation management and localized emergency management system.

On the other hand, the disaster risk index among coastal communities is statistically high in terms of awareness and knowledge on disaster risk reduction protocol, household disaster mitigation management, and localized emergency management system while coastal communities are moderately prepared in terms of structural adaptation and governance.

Finally, the study concluded that disaster preparedness practices matter to political leadership as well as sufficient financial capacity to support disaster preparedness.

## Keywords

dimensions, disaster preparedness, coastal communities, exploratory factor analysis

## 1. Introduction

The impact of climate change is one of the serious problems globally. It triggers severe weather condition leading to massive community devastation that impedes social and economic development. The Intergovernmental Panel on Climate Change (2007) concluded that extreme weather events have increased in frequency and intensity over the last 30 years.

Moreover, the susceptibility of coastal communities to natural disasters became one of the common factors of economic failure, environmental degradation, damage to social infrastructure, threatened food security and disruption of social services that lead to severe poverty condition and death. Statistically, from 1970 to 2014, a total of 2 million death and \$2.8 trillion economic losses were caused by natural disasters in Asia and Pacific countries.

Geographically, Philippines belong to the "Pacific ring of fire" which means that the country is surrounded with active volcanoes making it susceptible to natural hazards such as earthquake that would result to tsunami. In addition, the Philippine Atmospheric Geophysical and Astronomical Services Administration (2010) reveals that an average of 20 tropical cyclones or typhoons enters the Philippine Area of Responsibility (PAR) annually, five of these are expected to create storm surge that causes severe damage to agricultural crops, infrastructure, and properties as well as injuries and loss of

lives among coastal settlers. This situation ranked Philippines as 2<sup>nd</sup> among the fifteen most disastrous countries in the world (UNISDR, 2014).

The local government units (LGU's) must strengthen its programs in community based-disaster risk management and climate risk management specially in coastal communities through capacity building, development of disaster plan and policies, institutionalizing community response volunteers, awareness advocacies in disaster preparedness, establishing early warning system, investment in infrastructures and emergency response equipment and strengthening networks and stakeholders in upgrading the community disaster preparedness. In such program, the vulnerable communities like the coastal residents become adoptive and resilient in natural hazards. Although, the National Disaster Risk Reduction and Management Council (NDRRMC) identified community awareness, community skills development, institutional capacity and disaster preparedness policies as well as plans and partnership as primary measures for disaster preparedness (NDRRMC Plan 2011-2028), the USAID (2007) framework on resilient coastal communities has developed coastal disaster resiliency measures according to governance, society and economy, coastal resource management, land use and structural design, risk knowledge, warning and evacuation, emergency response and disaster recovery. Hence, a local framework on disaster preparedness must be developed to suit to the characteristics of coastal communities in Davao City, Philippines.

This study therefore was carried out to determine the profile of residents and coastal communities, explore their disaster risk preparedness index, and develop a framework of disaster preparedness among coastal communities in Davao City, Philippines.

## 2. Material and Methods

Descriptive quantitative design was applied in the study using Exploratory Factor Analysis. This method has the capacity to extract the factors that describe the dimensions of disaster preparedness in coastal communities of Davao City.

The study made use of primary data which were gathered through survey questionnaire distributed to 360 Barangay Disaster Risk Reduction and Management Committee (BDRRMC) members as well as to the selected coastal residents from January to May, 2015. Also, key informant interview with Barangay Chief Executive and BDRRMC Action officers of 9 coastal communities (Tibungo, Ilang, Sasa, Matina Aplaya, 76-A Bucana, Talomo Proper, Daliao, Lizada and Binugao) Davao City was conducted.

The data was processed to describe the respondent's socio demographic characteristics and the profile of the coastal communities in Davao City and analyzed through frequency counts and percentages. Likewise, the data gathered was statistically analyzed using Exploratory Factor Analysis (EFA). This statistical tool identified the dimensions of disaster preparedness among coastal communities in Davao City which was later developed into a framework. The Kaiser Meyer Olkin measure of sampling adequacy was used to test the magnitude of partial correlations among variables. Bartlett's test of sphericity on the other hand tested whether the correlation matrix was identity matrix or not. The scree plot was applied to graphically determine the dimensions of disaster preparedness among coastal communities.

## 3. Results and Discussion

### Profile of Coastal Communities in Davao City

The profile of coastal communities in Davao City includes Internal Revenue Allotment (IRA), coastal hazards experience, and types of coastal hazards experienced.

#### Barangay Internal Revenue Allotment

The study revealed that Barangay 76-A Bucana has the highest accumulated revenue amounting to 47 Million annually. The Philippine law says that at least 5% of the IRA will be allocated for disaster preparedness and response. Furthermore, Barangay Matina Aplaya has total revenue amounting to 16.6 Million for the development of the Barangay with Php830,000.00 allocation for Disaster Risk Reduction. The Barangay Talomo Proper which ranked 1<sup>st</sup> in disaster prone Barangay in Davao City has declared 30 Million annual revenue allotment with a summation of 1.5M budget for disaster preparedness programs to increase knowledge and capacity to cope with natural disasters. However, The Barangay Ilang in District 2 has a total revenue amounting 10.6 Million which have 5% computed budget for DRR programming amounting to Php530 thousand while Barangay Tibungo bears 20.5 Million internal revenue per year. Barangay Sasa, where the sea port and airport are located, declared 35 Million IRA. However, Barangay Binugao only gained a total of

2.5 Million revenue annually. Barangay Daliao, known as the “fish basket” of Davao City and most of the coastal areas were occupied with private resorts which accommodate local tourists generated an annual IRA amounting to 11.5 Million. In addition, the 10 Million IRA of Barangay Lizada is generated from the coconut and mango processing plant and commercial buildings significantly helped to increase the Barangay disaster preparedness through trainings and purchasing of disaster equipment.

Generally, this would imply that coastal communities which have high Internal Revenue are likely to be more prepared in coastal disasters because of their financial capacity to fund disaster preparedness programs.

#### **Types of coastal hazard encountered**

The study found out that the coastal communities in Davao City experience high waves or storm surges which can reach an average of 4-5 feet high during northeast monsoon. The communities also encountered flooding and fire. Hence, disaster preparedness can be realized and seriously implemented if the Barangay experience frequent calamities that incurred tremendous impacts to communities especially in 1<sup>st</sup> district of Davao City.

#### **Disaster Risk Reduction and Climate Change Adaptation (DRR-CCA) Trainings, Seminars and Activities Attended by the Residents of Coastal Communities**

Most of the respondents had several experiences in Disaster Risk Reduction skills training and activities in school and communities. These include Tsunami and Earthquake simulation drill which rank 1<sup>st</sup> among the list of trainings were attended by 280 respondents or equivalent to 81.9 percent. It is followed by the First aid and Basic life support training which attended also by 248 respondents or 72 percent of the total samples had experienced the training conducted by red cross and 911 medical volunteers in Davao City. Coastal respondents of this study reveals that 70.8 percent or 242 out from 360 respondents had undergone Disaster Risk Reduction and Management Orientation while only 64.6 percent or 221 respondents participated on the Contingency Planning Training (CPT) and development of Barangay contingency plan. Moreover, based on the overall number of respondents, only 179 or 52.3 percent had experience to participate Hazard, Vulnerability and Capacity Assessment in coastal barangays in order to identify coastal hazards. However, even if the Department of Education (DepEd) is aggressively campaigning for a safe and conducive learning environment for learners, only 33.9 percent or 116 respondents from the ever all samples had been oriented on the Comprehensive Safe School Framework. In terms of specialized and skills training among the respondents, Water Search and Rescue (WASAR) ranks 7<sup>th</sup> with 115 or 33.9 percent among the participants took the training while only 35 coastal settler respondents or 10.2 percent were equip with swift water rescue and Fire Suppression skills. In general, most of the respondents acquired training especially on Tsunami and Earthquake evacuation management factors that justifies the result which the community respondents are more aware knowledgeable in disaster preparedness protocols which gained through skills development.

#### **Dimensions of Disaster Preparedness among Communities of Coastal Barangay's of Davao City**

This part presents the analysis of the EFA through KMO, Bartlett's Test and the Total Variance Explained which resulted to the birth of five dimensions of disaster preparedness among communities of coastal barangay's of Davao City namely; awareness and knowledge on disaster risk reduction protocol, structural adaptation, governance, household disaster mitigation management and localized emergency management system.

#### **KMO and Bartlett's Test**

Table below shows the Keiser Meyer Olkin Measure of Sampling Adequacy and Bartlett's test of sphericity with a .4 set of accepted value which consider the 25 set of alteration and one (1) Eigen value. The Keiser Meyer Olkin measure of .948 which implies that the sample sized are in high correlations and it recommends for factor analysis which fits for data processing. As shown, the Bartlett's test of Sphericity yields a value of 8.75 and a level of significance smaller than .005 means that it allows the data to proceed on factoring the dimensions of disaster preparedness among communities of coastal barangays of Davao City. Moreover, the Bartlett's test of Sphericity signifies to reject the null hypothesis and therefore the researcher concluded that awareness and knowledge on disaster risk reduction protocol, structural adaptation, governance, household disaster mitigation management and localized emergency management system significantly belong to the framework of disaster preparedness among coastal communities in Davao City.

**Table 1.** KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.948
Bartlett's Test of Sphericity	Approx. Chi-Square	8.752E3
	Df	630
	Sig.	.000

**Total Variance Explained.** As presented in the following table, there are 5 dimensions extracted that define the framework of the disaster preparedness in coastal communities of Davao City namely; awareness and knowledge of disaster risk reduction protocol, governance, infrastructure, disaster mitigation management and emergency response.

**Table 2.** Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Vari- ance	Cumulative %	Total	% of Vari- ance	Cumulative %	Total	% of Vari- ance	Cumulative %
1	16.187	44.965	44.965	16.187	44.965	44.965	5.462	15.172	15.172
2	2.044	5.677	50.641	2.044	5.677	50.641	5.350	14.862	30.034
3	1.848	5.134	55.776	1.848	5.134	55.776	4.524	12.567	42.601
4	1.173	3.258	59.033	1.173	3.258	59.033	3.754	10.428	53.030
5	1.085	3.013	62.046	1.085	3.013	62.046	3.246	9.017	62.046

Extraction Method: Principal Component Analysis.

### Rotated Component Matrix with the 36 component attributes

There are thirty six items presented subject for statistical treatment using Exploratory Factor Analysis (EFA). As a result, the thirty six items was able to organize according to its context which becomes the primary guide to conclude that there are 5 dimensions which were developed in the categorization namely *Awareness and Knowledge on Disaster Risk Reduction Protocol, Infrastructure, Governance, Household Disaster Mitigation Management and Localized Emergency Management System*. It is based on the standard rule of exploratory factor analysis (EFA) in which the variables with Eigen values less than .4 will be eliminated in the factoring.

### Rotated Component Matrix with group attributes

The thirty six items in the survey questionnaire were subjected to factor analysis component with varimax rotation or rotated component matrix, a statistical treatment applied to identify relatively small numbers of factors that can be used to represent the relationship among a set of many interrelated variables (Norusis, 1990). Based on the technique, there are five dimensions identified with their respective indicators.

### Awareness and Knowledge on Disaster Risk Reduction Protocol

Items that fall under dimension 1 which is Awareness and Knowledge on Disaster Risk Reduction Protocol include impact of natural calamities in coastal communities can be avoided or reduced but it requires cooperation, awareness and capacity to respond among vulnerable coastal settlers. As an output of Exploratory Factor Analysis (EFA), disaster readiness can be measured in terms of awareness on the action taken in case of coastal disaster like Tsunami and Storm Surge with a score of .726. In addition, capacity to manage water search and rescue operation in times of calamities become one of the most important component in disaster preparedness which acquired a total score of .535. As basic foundation among vulnerable settlers, they should have deep knowledge on coastal hazard gaining a score of .713. The political leadership in conducting coastal community hazard assessment and contingency plan development generated a total score of .538. Importantly, household/family participation in disaster preparedness drills and simulations to increase the capacity to respond natural hazards comprised a total score .693. Higher authority requires full community participation

on the event of pre-emptive evacuation information to reduce the impact with a score of .516. On the other hand, family/household awareness on the Coastal Based- Early Warning System protocols with a score of .578 and the capacity to utilize social media for disaster risk reduction and preparedness campaign garnered a score of .474. Then, family orientation on the safe evacuation route map of the Barangay going to evacuation site got a score of .515 and the BDRRMC awareness on its specific rules and functions in respond to coastal disaster with a total score .512.

This finding coincides with the study of Asian Disaster Preparedness Center (2015) that identifies knowledge, innovation and education to build a culture of safety and coastal resiliency can substantially reduce vulnerabilities. On other hand, trainings and public awareness to enhance coastal community knowledge and awareness remains best strategy to advocate disaster preparedness in all levels.

### **Infrastructure**

The second dimension of coastal preparedness comes with infrastructure. Normally, after the disaster, common impacts were damage to livelihood, casualties and loss of shelters particularly among coastal settlers. But still, the local government units (LGU) of Davao City allows informal settlers to occupy or build permanent residencies in the identified “No Build Zone” in the coastal areas without disaster mitigation or barriers to protection mechanism among coastal settlers. To note, wide part of this coastal communities of Davao City are reclaimed areas.

The researcher concluded that household disaster information dissemination initiatives in the event of calamities have significant contribution under the dimension of infrastructure with a score of .524. Also, household and family orientation on DRR-CCA concepts gained a score of .531 that introduced knowledge which eventually guided vulnerable settlers to increase the awareness through capacity building initiatives and participate to evacuation process in times of disaster. Capacity to facilitate psychosocial intervention and stress debriefing to affected household members both children, youth and adult with a score 6.93 while the responses for the assessment of structures such as sea walls, evacuation centers and houses are designed as Tsunami and storm surge resistant with a score .613. Most of the structural designs especially houses are made of light materials without sea walls or mangroves that protect them in the event of tsunami or high surges. Moreover, a local government unit has initiative and support for constructing evacuation centers and relocation sites with a total response of .667. Furthermore, trainings conducted on R.A. 10121 or known as Philippine Disaster Risk Reduction and Management Act of 2010 particularly on the utilization of funds accumulated a score of .646 while the program of Department of Education to integrate DRR-CCA in the curriculum both primary and secondary acquired a total score of .664 followed by orientation on comprehensive safe school framework which means only fire and earthquake drill with a score of .64. Partnership in strengthening family disaster preparedness programs gained a score of .564 while having regular intervention with local and private partnership specifically during regular facilitation of Barangay earth quake drill gained a score of .449. This implies that, the motivation of the coastal settlers to improve housing design and seeking of support from local government units to install coastal protection mechanism can be achieved through orientation and trainings on DRR-CCA policies.

### **Governance**

The third dimension of coastal disaster preparedness concentrated on governance management. Major component of disaster preparedness comes from leadership and political will. In a development perspective, local policy advocacy for disaster prone coastal settlers with a score .498 should be initiated first, as the guiding principle among the residents. However, political battle policies remain in vain while disaster affected communities suffer because of ignorance. As part of disaster preparedness advocacies, Barangay Disaster Risk Reduction and Management also has alternative campaign for sustainable coastal livelihood among coastal settlers with a score .703. In many cases, understanding BDRRMC action committees about their key responsibilities in disaster risk reduction and management gained a score of 0.568 which most of the time is impotent in the event of calamities. Davao City strictly implements the RA 9003 which supported the City ordinance on Waste segregation practices in all barangays particularly in coastal household residents that gain a total score of 0.724 while knowledge in incident command system management acquired a score of 0.657 and community participation in planning for the utilization and appropriation of Barangay Disaster Risk Reduction Fund (BDRRMF) got a score of 0.437. The result means that waste segregation remained a practice among coastal settlers while community respondents have low participation in the planning for proper appropriation of disaster funds.

This finding was supported by the study of (Brunner et al. 2005; Holley et al. 2011) which concluded that building coastal disaster resiliency through governance includes institution, organization, laws regulation and contribution from civil society as well as private sector that influence risk management. Therefore, it proved that organizing Purok Disaster

Action Team (PDAT) in Barangay 76-A as well as rescue volunteers in all coastal respondent essentially helps to speed up disaster preparedness advocacies.

#### **Household Disaster Mitigation Management**

The fourth dimension is the disaster mitigation management. The extent of damage to public and private investment, livelihood, and massive casualties caused by natural hazards can be minimized if local chief executives and community members work hand-on-hand in planning for the installation of mitigation measures to the identified hazard prone areas. Effective mitigation mechanism can be structural or non structural initiative. Non structural includes capacity to manage camp and evacuation operation with a score of .485 and household awareness on basic life support or first aid can also be associated as mitigation practices to avoid life loss having a score of .464. Similarly, family disaster preparedness kits and availability of ‘Go Bag’ or Emergency Kit in the house to prevent famine in case of calamities gained a score of .695. Meanwhile, the establishment of barangay disaster operation centers and management can be categorized under structural mitigation with a score of .601. One of the effective strategies to mitigate coastal hazards that the local government should allocate fund for is the establishment of barangay coastal barriers and buffers for tsunami and storm surges with a score .692. This strategy is much expensive and requires millions of pesos to build structural protection mechanisms like sea walls. As an option, coastal barangays can initiate mangrove reforestation that serves as alternative mitigation while strengthening family awareness on the barangay disaster preparedness plan and evacuation plan with a score of .566 could also help to mitigate coastal risk.

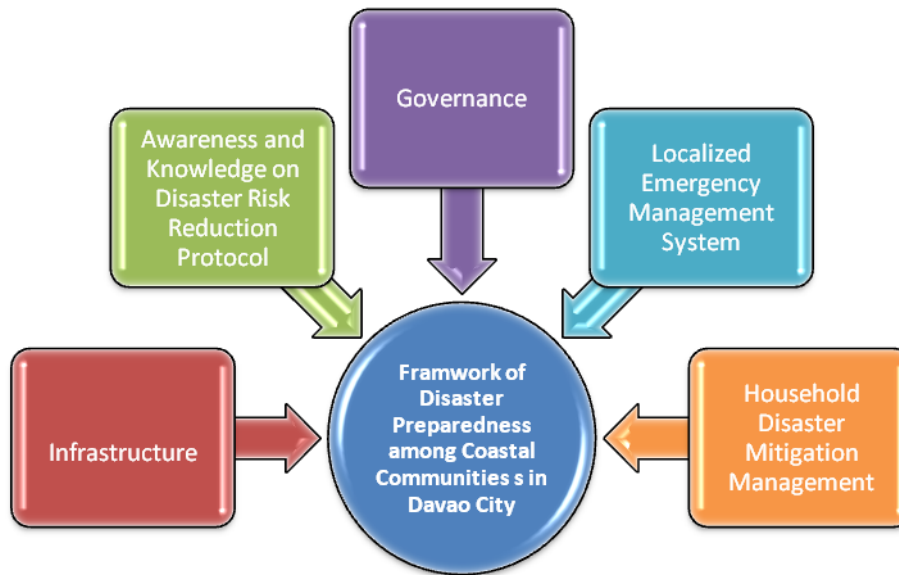
This finding was proven under thematic area 1 of the NDRRMC Plan 2011-2028 that recommends disaster prevention and mitigation as part of fundamental areas for preparedness under the sole mandate of Department of Science and Technology. This plan includes effective community based scientific DRRM and CCA assessment, mapping analysis, monitoring, infrastructure development and community awareness advocacies.

#### **Localized Emergency Management System**

The fifth dimension developed is called localized emergency management system. In the Disaster Risk Reduction and Management Cycle, emergency management serves as the most critical part in an event of disaster. The Republic Act 10121 allows the 5% allocation from Internal Revenue Allotment (IRA) that can be properly utilized to respond to the most urgent needs such as food, hygiene kit and temporary shelters of the affected population. In preparation, the barangay council should support for organizing emergency response volunteers having a score of .64 to prevent mass casualties while barangay budget for emergency response equipment such as life vest, rescue boat, first aid, and flash lights gained a score of .426 that serves as primary equipment to conduct rescue and retrieval operation. Furthermore, the most important thing is family understanding on Philippine Storm Warning Signal issued by Philippine Atmospheric Geophysical Astronomical Service Administration (PAGASA) in the event of typhoon that gained a score of .634 can be institutionalized to escape from the tremendous devastation and a total response of .439 on the capacity to conduct community damage needs assessment to urgently evaluate the extent of damage for the declaration of state of calamity and resource mobilization.

#### **Framework of Disaster Preparedness among Coastal Communities in Davao City**

The framework that was developed containing all the dimensions of disaster preparedness among coastal communities in Davao City are knowledge and awareness on disaster risk reduction protocol, infrastructure, governance, household disaster mitigation management and localized emergency management system. These dimensions strengthen the coastal disaster preparedness practices and most especially all coastal settlers to proactively participate in DRR-CCA skills development for sustainable and resilient communities.



**Figure 1.** Framework of Disaster Preparedness among Coastal Communities in Davao City, Philippines

## Conclusion

Based on the result, the researcher concluded that there are five underlying dimensions of the framework for disaster preparedness among coastal communities in Davao City. This framework has the capacity to guide local authorities and organizations in crafting better policies to strengthen each community in the coastal areas in preparing themselves for possible disasters that would strike them. Furthermore, this framework shall provide basis in making prioritization schemes of the projects that the local authorities will undertake to mitigate disasters in the coastal communities.

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