

Community Resilience to Address Urban Vulnerabilities: A Case Study of Flood-prone Communities

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Abstract

Urban vulnerability is a priority concern and communities must build resiliency to respond to disasters and mitigate its negative impacts. This is a case study on the 2011 Matina flash flood affecting thousands of families in the following barangays: Matina Crossing, Matina Pangi and Matina Aplaya. The study areas are heavily populated, with business, and institutional establishments. Using the qualitative method, this paper highlights the vulnerabilities of the community and examined the role of risk communication and social capital that enable communities, groups and institutions respond quickly to the hazards of flooding. Review of literatures reveals that Davao City is a flood prone area, major tributaries drain towards the Davao Gulf. Affected families in these areas comprised 61.57% of the total affected families of the 2011 flash floods. The average number of households per family is 4.3, while the total number of casualties reached 29 – majority are women and children. Results of the study revealed that despite the lack of communication management protocols, there is a strong sense of social capital exhibited by communities, institutions and various groups involved in the emergency response. Inter-governmental, and cross boundary efforts for climate change adaptation initiatives to reduce vulnerabilities among communities must be factored in given the nature of ecosystems and river systems draining towards Davao Gulf. Further it is recommended that ecosystem-based and community-based adaptation be explored to build more resilient communities who able to with stand and reduce vulnerabilities during natural hazards such as flooding.

Keywords: *community urban vulnerability, community resilience, urban flooding, social capital, risk communication*

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1. Introduction

The interplay of disaster and urban development is recognized in literatures that determines vulnerability during natural calamities such as flooding in urban areas. However, disasters also open new avenues for addressing weaknesses in both social and physical dimension of development, especially in densely populated urban areas. Disasters that we experienced and anticipated to happen are subject to serious global and domestic policy issues and concerns. It magnifies the vulnerability of communities (Stephenson, 1994; Auzzir et al., 2014; Carasco et al., 2016; Comfort et al., 1999; Mochizuki et al., 2014).

Rapid urbanization is happening at a global scale. Development towards metropolitan growth is an observed trend globally. The 20th century is witnessing rapid urbanization, transforming many semi-rural areas into master planned communities bustling with commercial, residential and leisure activities. Meanwhile, it has also facilitated spill over development in the fringes of these master planned communities. Communities arising from spill over would include informal settlers and associated issues with them (i.e. basic amenities, sanitation, education, peace and order, etc.). This plethora of issues, along with infrastructure development and traffic congestion, pose serious challenges to urban planners and policy-makers. As such, cities and urban areas are considered critical components of global sustainability as well as drivers of global transformation (Ramachandra et al., 2012; McPhearson et al., 2014).

Davao City is experiencing unprecedented development in recent years, and more so with the current administration's "Build, Build, Build Policy" for infrastructure and development, urban sprawl is evident while sustained growth in central business district allows population to increase in magnified proportions. This puts consequent pressure on infrastructure, natural resources and ultimately contributing to the worsening global challenges on climate change, enhanced green-house gases emissions, lack of appropriate infrastructure i.e. flood control, traffic congestion, and lack of basic amenities (electricity, water, and sanitation) in many localities. The International Bank of Reconstruction and Development in 2012 considered flooding as the most occurring natural event in the urban areas, thus, "poses a challenge to development and the lives of people, particularly among the residents of rapidly expanding towns and cities in developing countries", this reinforces the frequency of typhoons and storms that pass through the Philippines makes it more vulnerable to flooding (Magalang, 2010).

Having an area of 244 thousand hectares, Davao City is among the largest city in the world in terms of area. It may be located in typhoon-free zone, but it is susceptible to dangerous

floods in areas adjacent to the city's rivers (World Bank, 2015). Largest waterways drain into the Davao Gulf, particularly Davao and Talomo Rivers considered as most important river basins in the city and pass through heavily populated areas in the city. Hence, thousands of residents are most likely to be affected in case of flooding (Magalang, 2010).

Davao river is one of the seven catchments which has the largest catchments area of about 1,647 square kilometers. Along with the Davao River Basin is its sub-basin, the Matina River Basin. Barangay Matina Crossing 74-A is situated in the Southwest portion of Davao City with a total land area of 568 hectares. It has a flat topography stretching towards the Davao Gulf. Sixty percent (60%) of its land area is residential, thirty-nine (39%) is composed of commercial and light industries and about one percent is used for agricultural purposes. It covers sixty-three (63) *puroks* under its jurisdiction, which makes it one of the biggest *barangays* in the 1st Congressional District of Davao City (Estacio, 2013; Sanchez, 2014).

Hence, during heavy down pour, especially in the upland areas, river overflows. One case in point is the flashflood of June 28, 2011 that struck Matina, Davao City in Southern Philippines which has taken tolls on property and lost lives.

This case study described the impact of disaster on development and vice-versa, focusing on the case of the 2011 flashflood incidence of Matina, Davao City, which aimed to:

1. Describe the general background/situation of the study area (pre-disaster stage).
2. Narrate how the local institutions, groups, individuals' response measures during and after the flash floods (disaster stage).
3. Discuss the consequences (e.g., casualty, damage to properties, etc.) of the 2011 flashflood (post disaster stage).
4. Identify some of the factors that contributed to the disaster.
5. Discuss some of the post crisis programs undertaken by the different sectors.
6. Analyze and present the insights drawn from the disaster experience.

2. Literature Review

2.1. Resilience and Vulnerability

Literature reveals that there is a link between resilience and reducing vulnerability (Badri, 2006; Balang, 2010; Gall, 2013; Bene et al., 2012; David, 2010; Garcia, 2010). The higher the resilience, the higher is the reduction of vulnerability. Through its capacity to evoke systemic adaptation before and after disasters, resilience has become a seductive theory in disaster

management. Building community-based systems of disaster management and resilience has been an objective of various urban planners, government agencies and other institutions (Oh et al., 2014; Carrasco et al., 2016; Tselios & Tompkins, 2017).

Lizarralde et al. (2015) noted that several studies have linked the concept of resiliency with systems theory; however, they have been mostly based on theoretical models with limited empirical support. For instance, the study of the Cuban model of resilience sheds light on the variables that create systemic resilience in the built environment and its relations with the social and natural environments. Cuba is vulnerable to many types of hazard, yet the country's disaster management benefits from institutional, health and education systems that develop social capital, knowledge and other assets that support construction industry and housing development, systematic urban and regional planning, effective alerts, and evacuation plans. Similarly, building disaster-resilient communities (Badri, 2006; Balang, 2010) have been initiated in some areas in the Philippines that aimed to reduce community vulnerabilities to disasters by incorporating DRR into their community development programs (David, 2010). The pilot projects documented include: early warning system (Garcia, 2010), vulnerability reduction & social protection and participatory disaster-responsive governance (Dela Cruz et al., 2010). Moreover, building disaster-resilient communities to reduce vulnerability proves to be effective using the community-participatory approach (Cadag & Gaillard, 2012). Some of the documented initial projects in the Philippines have shown that the more involved are the community and stakeholders, the higher is the assurance of effectiveness.

There is a growing consensus among researchers and planners to incorporate local communities in disaster risk management and climate change adaptation planning, yet its actualization largely remains a dream (Pearce, 2003 cited in Samaddar et al., 2015). Since it was observed that the Philippines, over the last decade, has been ranked 10th in the 2007 Global Risk Index (Harneling, 2008 as cited in dela Cruz et al., 2010), it has been considered as one of the most vulnerable countries in the world due to the occurrence of recent severe disasters.

2.2. Role of Communication on Disaster Interventions

There are a number of local studies that have been documented in relation to the use of communication as a tool for disaster preparedness. Estacio (2013) made a study documenting the methods used by the local barangay unit in the post crisis phase of the flashflood. Her study

employed the Coombs' 3-Phase model, the Diffusions of Innovation Theory and Trish Center Scholars' Crisis Management Cycle. Results of the study revealed the organizational learning of the baranggay from the disaster were transformed into strategies that can be utilized in preparedness and recovery stages of their disaster management process. On the other hand, Sanchez (2014) investigated the IEC strategies and programs for the residents' risk management and precautionary practices towards flood incidents using the Precaution Adoption Process and Berlo's Communication models. Results of her study show that communication plays a vital role for the residents' risk awareness and preparedness on disasters. Montajes (2015) investigated the disaster preparedness and awareness level of the community in Banay Banay Davao Oriental (Sanchez & Sumaylo, 2015). Her results show that at the barangay level, there is still a need to "localize" the approach on disaster campaigns, preparation, and communication approaches. These studies highlight the need for a community-based disaster communication systems and protocols.

Meanwhile, Bradley et al. (2014) presented a systematic review of intervention studies using disaster risk communication. Five studies were presented that promote preparedness for natural disasters such as flashfloods, earthquakes, five natural hazards and general preparedness. Results show that interventions using communication tools have increased awareness on natural hazards, upgraded knowledge on preparation, evacuation and recovery from disaster. One study involves communication preparedness for man-made disaster like nuclear or radiation incident in New Jersey that resulted to effective awareness campaign on the identification of the warning signs of the incident. Three studies were mentioned on the effect of risk communication interventions to improve disaster recovery: one study conducted after the 911 New York terrorist attack and two studies after the Hurricane Katrina in New Orleans. The studies revealed that media campaigns are effective tools to solicit financial support to fast track recovery period of the victims of the disaster. Three studies focused on communicating early warning on natural disasters, specifically, the Tsunami in Mauritius, Cyclone in India and Evacuation during wildfire in California, USA. Results reveal that responses to communication signals for early warning purposes have been affected by different factors like personal circumstances, beliefs and attitudes, societal response, characteristics of the disaster, level of persuasion of the authorities to evacuate, the setting where the disaster occurred and the nature of the communication messages used. The 12 studies enumerated revealed improvements on disaster-related knowledge and

behavior. However, due to the differences and variations in context of the studies, it was impossible to conclude that one method of risk communication is superior to others.

Similarly, Zhang et al. (2007) worked on post-disaster field survey to establish the bottleneck of disaster risk communication during the early warning and evacuation in Japan. Results of the case studies reveal that there is a problem at the level of transactions between the agencies/institutions concerned and the local community levels. Incidentally, Terry and Fellows (2008) studied hurricane Katrina and explored the “inadequacies” of the risk communication based on Lundgren and McMakin (2004) and Rowan’s (1991) rhetorical perspective. Results show that while care communication was adequate for its purpose, inadequate clarity, insufficient credibility and failure to adapt to critical audiences resulted in failure of consensus communication and crisis communication. These studies suggest that there may be a need to propose a policy modification as well as explore a new model of communication transfer from the institutions to the local communities, emphasizing the significant role of communication management on risk and disaster-related messages.

2.3. Social capital and Resiliency

Social capital may be defined in different ways according to the context where it is applied. In the case of disaster situations, the term may refer to resources i.e. trust, norms and networks of associations inherent in social relations which facilitate collective action for a common purpose (Daniel & Meyer, 2015; Vandaie, 2007). In addition, the Australian Red Cross (2014) emphasized that building relationship and ties is crucial for social capital to play its positive role to disaster resilience.

As resilience has been identified as the ability to recover from natural disasters, it has been noted that majority of countries worldwide focus their attention on disaster preparedness. Noteworthy to mention that a lot has been devoted to building shelters, evacuation areas, providing capacity through drills (Badri, 2006; Bene, 2012; Cadag & Gaillard, 2012). However, recent literature reveals that recovery patterns of majority of documented disasters have focused on resettlement highlighting the role of institutions, other agencies and public and private partnerships (Carrasco et al., 2016; Auzzir et al., 2014; Tselios & Tompkins, 2017; Comfort & Kapucu, 2005). Moreover, studies have been devoted to policy analysis (Kim et al., 2017; Koivisto & Nohrstedt, 2017) related to community’s response and behavior to disasters, how youth can be involved in preparedness, rescue and recovery (Helsloot & Ruitenbergh, 2004;

Fernandez & Shaw, 2013; Carcellar et al., 2011).

Social capital, therefore, has been considered as one of the strategies to reduce vulnerability and increase community resilience. There is an increasing trend on the shift of the attention of disaster interventions from the scientific, technical and physical structures into building social ties and cohesion. The role of social capital has been slowly being given due attention and focus. Nahapiet and Ghoshal (1988) viewed that social capital can be measured through three dimensions: (1) structural referring to network ties, configurations and appropriate organizations; (2) relational as trust, norms and identification, and (3) cognitive covering shared goals and culture.

3. Methodology

This case study, utilizing the qualitative method, assessed by the approaches of document analysis, Key Informant Interviews (KII) and focus group discussions, investigated the case of a flashflood using the Wisner et al.'s (2004) Crunch model. The model is able to identify the factors leading to progression of vulnerabilities, capture causal factors, concerns and the institutional as well as the social dynamics of the natural disaster.

The works of Khan et al. (2008), Estacio, (2013), O'Brien et al. (2006), Olson & Gawronski (2010) and Reid (2015) indicate that this model is useful to assist in disaster management during major emergencies and can help organizations build resilience (Lizaralde, et al., 2015; Saño, 2010; Villanueva & Aid, 2010; Samadar et al., 2015).

The following procedures were undertaken:

- 1) A review of related literature consisting of reports, existing plans, previous cases and other materials were scanned, examined and utilized, i.e. reports, journal articles, LGU plans (CLUP, geo-hazards, NDRRMC Plan)
- 2) The post disaster report of the 2011 Matina, Davao flashflood was the major data utilized to describe the situation and the relevant information about the disaster.
- 3) Key Informants were interviewed and focus group discussions were done among the *purok* leaders to validate the secondary data and provide testimonials on the disaster event to help describe the post disaster activities as well as the dynamics of the community interaction and communication protocols.

- 4) The analysis of data and information generated from secondary sources were interpreted using literature on disaster, vulnerability, and development from related literature.
- 5) Implications and recommendations were done on the case studied in the context of the correlation between disaster and development, specifically, the mitigation strategies to reduce vulnerability in an urban setting.

4. Results and Discussion

4.1. Pre-disaster Situation

The locale of the study includes the communities living in Matina Crossing, Matina Pangi and Matina Aplaya. The area consisted of both minor and major commercial zones characterized by presence of small, medium and large commercial establishments. Further, institutions like banks, schools, groceries and public markets are found in the area. The Office of the City Planning and Development considered the area as urban with a high density residential zone and socialized housing zone (Table 1).

Table 1

Population Distribution of Matina, Davao City

Barangay	Household Population	Number of Household	Average Household Size	Population Density	Built Up Density
Matina Aplaya	29,619	8,022	4.2	96.67	1.23
Matina Crossing	34,003	3,083	4.2	64.55	0.70
Matina Pangi	13,625	13,545	4.3	21.24	1.13

Classified as Urban area as identified by the OCPD as per guidelines of National Statistics Office

However, it is also considered a flood risk area with flood mitigating zones were two major rivers run along the several barangays in Matina, namely: Pangi River (which cuts across Purok Sambag, San Isidro, Guadalupe, Mahayahay, Arroyo compound, Balusong, Lopez Village, Alzate compound, Concepcion compound and Doña Francisco) and Davao River which sets the boundary of the two *puroks* in Matina Gravahan. As recorded by the Barangay Office, the *puroks* enumerated above were inundated by the overbanking of the two rivers situated near them for the past years.

4.2. The Disaster Occurrence: The 2011 Flashflood

The Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAG-ASA) identified an Inter-tropical Convergence Zone was present in the southern part of Mindanao and this ITCZ was caused by the convergence of two trade winds-nor east trade winds and southeast trade winds in a particular area. The convergence of these winds resulted to thunderstorm clouds. The formation of thunderstorm clouds in the uplands of Tugbok District where the Pangí River originates along with Calinan and Talomo, generated heavy rain which lasted for about three hours. The heavy pouring of rain resulted to the overflowing of the Pangí River, which brought a destructive flashflood to riverside communities.

In the previous years, barangay Matina experienced a couple of flooding in these areas, however, the June 2011 flashflood was an unexpected disaster that resulted to loss of lives and damage to properties.

At the onset of the flashflood, the response team of the barangay and other agencies were not able to penetrate immediately the affected areas due to the forceful and risky current and height of the floodwaters. It was only when the water started to subside those responders were able to reach the affected areas.

4.3. Post-disaster Situation

4.3.1. Impact of the disaster

The city government reported 29 casualties due to drowning, having more number of females than males and majority were children ages 8 months to 9 years old. This data shows the most vulnerable groups were the ones greatly affected by the disaster. Hence, the interaction of the hazard (flood) with the vulnerable group (children and women) in an unsafe condition resulted to disaster. Table 2 below shows the summary of the impact of the disaster among the areas of the study:

Table 2

Affected barangays and families

Barangay	Affected Areas	Affected Families	% to Total Affected Families*
Matina Crossing	13	5,660	40.45%
Matina Pangí	8	1,500	10.91%
Matina Aplaya	13	1,304	9.49%

**Total # of affected families in Davao City = 13,746 from 46 areas including two other barangays, Talomo Proper and Maa (Source : NDRMC Siterep #8, 3July2011)*

4.3.2. The Role of Social Capital and Communication in Recovery and Response

Records of testimonials from the victims, reports from the government agencies and documentation of the disaster incident revealed the immediacy of response and action of the different agencies and concerned organizations to assist the affected areas within the first six hours of the disaster. Massive evacuation efforts were done to put victims on safer grounds, first-aid teams immediately addressed medical concerns upon arrival at the evacuation areas. The barangay captain, Mr. Joel Santes immediately initiated community kitchen to feed victims. Furthermore, it was observed that relief goods from both government and non-government agencies, church-based sectors and concerned individuals and groups arrived within the first 24-hours from the onset of the disaster.

Reports also reveal that various organizations and NGOs, in addition to the government agencies were identified as responders of the disaster: Barangay Matina Emergency Unit; Barangay Bago Aplaya VEST; Barangay Baliok EAST (Emergency Assistance Service Team); Barangay San Antonio SAVED; Phil Coast Guard, Philippine Navy, Philippine Army, Bureau of Fire Protection; 911 Urban Search & Rescue; Barangay Gov. Vicente Duterte DFRS, Knighthawk Foundation, Inc.; The City's Royal Blood Rescue Team, Kabalikat Civicom. However, despite the influx of agencies and organizations that were involved in the recovery and response, it did not achieve a zero-casualty situation.

Nyondo emphasized that if the process of communication is difficult in our ordinary and daily lives, it is far more so in times of disaster (Skinner & Rampersad, 2014). The challenge remains to not only respond with accurate, understandable, and complete information as quickly as possible during a disaster, but also to communicate in a proactive way that involves members of communities to reduce the potential risk of a disaster.

The case of the Davao flashflood revealed that an information melts down happened making the communities vulnerable to the disaster despite the immediate response of the different agencies involved.

Communication as a dynamic process with a twofold purpose can foster learning, positive change, and empowerment. It is a continuous process of coding, decoding and

interpretation and a way of sharing objectives, attitudes, knowledge, information, and opinions. It takes place in a social context and people take the roles of both source and recipient.

In addition, Abarquez and Murshed stated that when considering communication for disaster risk reduction, one should take into consideration that context plays a key role. The sociocultural context of the society, gender perspectives and scale of community (rural, small or mega) will determine how communication will be implemented (Skinner & Rampersad, 2014). Communication planning occurs in an organizational context and is embedded in institutional cultures with specific agendas. Moreover, communication takes place in a context of risk assessment, risk intervention and risk evaluation, making it a strategy that is executed within disaster risk management. Also, social vulnerability is key to determining the methods of communication and therefore people, complex social systems and non-structural solutions should be analyzed. This is in keeping with the general considerations in the ‘Priorities for action’ within the Hyogo Framework 2005–2015 (UNISDR), where each State has the primary responsibility for its own sustainable development and for taking effective measures to reduce disaster risk. These include ensuring cultural diversity, age, vulnerable groups and a gender perspective are integrated into all disaster risk management policies, plans and decision-making processes through which the State aims to protect its people, territory, infrastructure and other national assets from the impact of disasters.

4.3.3. Contributory Factors to the Flashflood Incident

The city government report reveal that although Davao City experienced flooding when it rains, it was observed that the heavy rainfall during the flashflood incident has accumulated more water at 60mm during the unholy hours of 10pm to 1am. Incidentally, the upstream areas of Mintal and Calinan have expanded its agricultural activities as well as changes in production activities to meet the demands of an expanding population, thus, affected the ecology of the soil. Moreover, the affected areas have been identified as an urbanized area, some of the riverbanks have been utilized as residential area due to the growing population, hence, decreasing the size of the waterways and flowing water diverts into the road networks. Similarly, as part of the city’s expansion and development, siltation and sandbars have been observed to occupy some areas of the rivers, thus, creating the backflow of the Matina-Pangi river during high tide (Duterte et al., 2016).

Despite the observed efforts and the preparedness level among the concerned agencies and sectors, initial post disaster studies on the flashflood incident revealed that there is a low awareness and level of risk perception among the communities. Further, there was a lack of communication protocols that led to the negative impact of the disaster incident. Hence, the gap of six hours before the initial response arrived may have a great impact if the community is aware on how they can perceive the risk level they are facing.

Another revealing factor contributing to the impact of the disaster was the lack of communication management and protocols among the agencies and organizations to properly address the synchronization and integration of the recovery and response activities as observed by the affected residents. There was also the observance of poor coordination across the inter-agency response system. This was also highlighted in the post crisis report prepared by the Davao City Disaster Risk Reduction and Management Office (CDRRMO) as one of the major areas that needs further improvement (CDRRMO, 2011).

4.4. Post Disaster Management

Building community resilience utilizing effective information dissemination and dynamic community-based preparedness would lead to better disaster mitigation strategies. Communication protocols, coordination as well as control should be observed at these critical situations (Comfort & Zagorecki, 2004; Comfort, 2007). In addition, there is a need to build relationships, social ties and inter-organizational coordination to sustain the strong social capital among the concerned communities with the varied organizations (Comfort & Kapucu, 2005; Australian Red Cross Report, 2012; Oh et al., 2014).

The communities learned the hard way from the disaster experience and immediately worked on the revival of their Disaster Reduction Management Team (DRRM). Programs for risk intervention were also revived and a more aggressive communication intervention for awareness and strengthen the capacity of vulnerable people of their barangay. These programs were made better in cognizance of the RA 10121. From a responsive approach, the community transformed into both responsive and proactive approach towards dealing with disasters, especially floods. Moreover, risk intervention programs were included in the post disaster strategies (Sanchez, 2014).

Similarly, the following measures were also undertaken as part of the Prevention, Preparedness and Mitigation strategies: detailed geo-hazard mapping in the Talomo and Matina-Pangi River watershed area as an intervening target for a Detailed Geohazard Mapping and Assessment Program (MGB Central, Regional Office & DENR); Updated floodway mitigating zone (Urban Zoning Map, 2013 -2022); established the Risk Reduction and Management Council; clear-cut program plans targeting/mitigating disasters including allocation of budget, improvement of the solid waste management, rehabilitation and improvement of drainage systems in Davao City.

5. Conclusion and Recommendations

Davao City is naturally a flood prone area as manifested by its physical characteristic. The implication is made more serious and magnified with the volume of population and human settlements found along the banks or nearby the river tributaries for example housing, business and institutional areas affected by the Matina flashflood.

The quick response and post management of the 2011 flash flood in Matina area exhibited a higher level of social capital among residents, various groups, and institutions in Davao. The incident revealed the interplay of institutional partnerships of the local government, private organizations and other groups and agencies. Simultaneously, these various groups have initiated rescue operations at the onset of the flashflood, showing that the response was quickly mobilized. One of its advantages is that the city has highly sophisticated search and rescue personnel with facilities and equipment through its Central 911. The trust and confidence shown towards government institution in the city is relatively strong based on the interviews. Their strength plus community mobilization made disaster response not only quick but effective as well. There may have been casualties recorded, mostly, vulnerable groups, i.e., women, children, and senior citizens, but this is not as high compared to other areas with similar situation. The Crunch Model is an effective tool in assessing vulnerabilities as it captures not only the factors and underlying issues that progresses/increases vulnerability among various groups and may further explore institutional and social capital dynamics.

Incidentally, the residents also revealed that there seem to be the lack of communication protocols that would synchronize the efforts done by the different organizations. Even the city government report emphasized that there should be an integrated approach to disaster rescue and

recovery efforts to ensure that all factors have been considered. Moreso, the impact of the disaster could have been minimized if appropriate communication and coordination protocols were in-place at that time. Thus, it was noted that there is a need to establish appropriate communication protocols and transactional management for a more effective disaster rescue and response system involving varied agencies, organizations, and stakeholders.

Flooding in Davao City should not only be approached within the confines of Davao City's geographical boundaries, since it involves multi-dynamics, and cross boundary issues. In this light, it is recommended for stakeholders to harmonize efforts and initiatives and find areas to work together given their varying interests – be it political, economic, and environmental. The interplay of roles of the varied organizations, including the NGOs and international volunteer organizations should be focused on implementation rather than conceptual levels. Moreover, it is also best to explore the ecosystem based and community-based adaptation measures. The latter will have significant contribution to building more resilient communities since it reflects the communities' priorities, knowledge, capacities, and coping strategies that are contextualized to their own experiences. Furthermore, it builds on human rights-based approaches to development that target the most vulnerable people and fully includes them in all levels of adaptation planning and implementation. In recent years, CBA has shown that it can also operate at scale but with communities remaining central to planning and action, for example through mainstreaming into government processes.

Moreover, the areas to work on should be at the forefront of discussion and decision-making among key players, i.e., LGU, development-oriented group, etc. The ecosystem-based adaptation (EBA) may have a strong community/participatory focus while effective community-based adaptation (CBA) can have a strong consideration of ecosystems and ecosystem services. This is where the real challenge lies --- in preparing communities for climate changes adaptation as well as building disaster resiliency. Consequently, long term perspective must be central to any development initiatives, specifically, in planning and development interventions to mitigate (if not avoid) flooding in Davao City, particularly in the flood vulnerable areas.

The flashflood disaster in Davao City shows that a strong sense of social capital was exhibited by communities, institutions and various groups involved in the emergency response. However, it can be further enhanced if communication protocols are in place. It is recommended that inter-governmental and cross boundary efforts be utilized for climate change adaptation

initiatives, highlighting the integration of social capital and communication protocols to reduce vulnerabilities among communities given the nature of ecosystems and river systems draining towards Davao Gulf. Finally, it is recommended that ecosystem-based and community-based adaptation be explored to build more resilient communities to reduce vulnerabilities during natural hazards such as flooding.

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