

# Vulnerability Profile and Risk Perception towards an Inclusive Disaster Risk Reduction for the Flood Vulnerable Communities of Davao City



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## Abstract

Development and disasters are closely linked but the cause-and-effect relationship between disasters and socio-economic development was ignored in the past. Thus, the United Nations International Strategy for Disaster Reduction (UNISDR) observed that disasters were seen in the context of emergency response and not as part of long-term development programming. Overtime, effects of disasters can seriously degrade a country's long-term potential for sustained development. Vulnerable communities of Davao City have experienced flooding that leads to catastrophic effects costing damage to properties and loss of lives. Communities need to build its resiliency to respond to flooding and mitigate its negative impacts, while policy makers and leaders need to consciously, regularly review and update its existing policies to address gaps and promote effective community engagement. This study aims to examine and analyze the respondents' vulnerability, awareness and perception of flood risks. A survey using multi-stage cluster sampling was conducted among 353 respondents from the top five (5) flood vulnerable barangays. Data from the key informant interviews and focus group discussions were also integrated to provide an in-depth explanation of the patterns emerging from the survey. Results of the study revealed that the vulnerability is associated with socio-demographic characteristics, experience in flooding and responses to flooding. Moreover, risk reduction strategies can be further enhanced through a risk communication management using a localized and participatory approach in the proper knowledge transfer of flood risk communication among the stakeholders involved. Community-based policies and well-defined communication processes must be strengthened to promote inclusive approach towards effective community-based disaster preparedness and management.

Keywords: inclusive disaster resiliency, flood-vulnerable communities, risk reduction, risk perception

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## 1. Introduction

The United Nations Office for Disaster Risk Reduction (UNDRR, 2019a) defined Disaster Risk Reduction (DRR) as “the concept and practice of reducing disaster risks through systematic efforts to analyze and reduce the causal factors of disasters. Reducing exposure to hazards, lessening vulnerability of people and property, wise management of land and the environment, and improving preparedness and early warning for adverse events are all examples of disaster risk reduction. Disaster risk reduction does not only include the disciplines like disaster management, disaster mitigation and disaster preparedness, but, greatly a part of sustainable development. In order for development activities to be sustainable they must also reduce disaster risk.” Moreover, unsound development policies will increase disaster risk - and disaster losses. Thus, DRR involves every part of society, every part of government, and every part of the professional and private sector (UNISDR, ND; UNISDR, 2007). Through DRR, countries can build resilience to disasters, however, it begins with effective disaster risk governance in a country and requires effective coordination mechanism within and across sectors involved (Kerstholt, Duijnhoven & Paton, 2017; Forino, et al., 2017). Mainstreaming DRR has been a goal for sustainable development (UN-ESCAP, 2017) and that it allows opportunities for the continuity of development initiatives (Kellet & Karavani, 2013; Oxfam, 2019). The United Nations estimates that yearly disasters worldwide cause some \$520B in economic losses and deplete public funds that can be diverted towards basic services and social protection. With the heightened awareness of risks, governments must make the necessary actions in developing disaster-resilient communities (Bacamas, 2018). In the Philippine context, the NDRRMC reported in 2017 that the economic cost of typhoons and flashfloods amounted to Php 6446B due to the 22 tropical storms, flashfloods and intertropical convergence zones. Flashflood damages has been estimated to Php 104,229M excluding the damages to private properties, commercial activities and foregone revenues from the hundreds of people who dies as a result of the calamity. Flooding is a potential threat with serious implications to development initiatives, especially in densely populated urban areas. It also exposes and increases communities to further risks and hazards. It has serious implications as well as open avenues for identifying areas of improvement on the social and physical dimension of a city’s development (Auzzir, Haigh & Amaratunga, 2014). Lasco, et al (2009) emphasized that the Philippines, in general,



is considered as very vulnerable to climate change as an archipelago. The frequency of typhoons and storms that pass through the Philippines archipelago make it more vulnerable to flooding (Magalang, 2010).

Ejeta (2018) stressed that past direct and indirect disaster experiences invoke preparedness intention and actual preparedness for flood hazards at individuals, communities and organizations levels. Even though the communities experienced the flood disasters in the past repeatedly, provision of information is needed on better emergency preparedness, particularly not only about the risk of flood hazards but also about the ramifications of flood disasters and the cost-effective methods of mitigation measures at the households' level and further explained that adoption of such non-structured measures is affected by residents' perceptions of previous flood experience, risk of future floods, reliability of public flood protection, the efficacy and costs of self-protective behavior, their perceived ability to perform these actions, and non-protective responses like wishful thinking (Grothman and Reusswig, 2006). Non-structural measures including establishment of communication channels between different communities to notify each other during the event of flood disaster, and the existence of flood disaster means of warning complement the structural measures like building of dams, dikes, levees, and channel improvements as means of mitigation measures (Ejeta, 2018).

In relation to the two national policies (RP Gazette, 2012) the Climate Change (CC) Act or RA 9729 of 2009 and the Disaster Risk Reduction and Management (DRRM) Act or RA 10121 of 2010, the role of the local government units (LGUs) as frontline agencies in the formulation, planning and implementation of climate change and disaster risk reduction plans in their respective areas have been highlighted. However, the barangays should be empowered by initiating participatory approach in developing the awareness, preparedness and mitigation strategies of the community. The inputs based from the experiences and local knowledge of the communities can be integrated into the DRR plans, thereby capturing the specific contexts of the different areas in the risk communication management. The paradigm shift on disseminating communication protocols, risk, and messages from top-bottom to a localized and participatory approach encourages a more transactional flow rather than a linear flow of communication.



The purpose of this study was to determine the importance of the vulnerability profile and risk perception in the promotion of an inclusive approach in the reduction of risk of flooding in Davao City. Furthermore, to analyze the relationship between the respondents' socio-demographic factors and their risk related behavior.

Findings of this study specifically in documenting the experiences, responses and perception of the community can be used by the local government units and agencies involved in disaster risk and reduction as feedbacks to their efforts in their implementation of the risk communication for reduction of flood risks; enhance the risk communication management of the local government units in addressing the needs and context of the flood vulnerable communities; and, provide policy-relevant information useful for the CDDRM Council and member agencies, the barangay leaders, and the Sangguniang Bayan as regards the plans and strategies in reducing the flood risk towards community resilience.

## **2. Literature review**

### ***2.1. Risk Communication, Risk Perception, and Social Vulnerability***

Risk communication is more than a research framework, Plough & Krimsky (1987) stressed that it has become a concept that is strongly marketed by specific interest groups and used instrumentally to achieve particular ends; thus, it has been recognized that appropriate communication is an essential part of risk and crisis management and not only important for the response to risks and crisis (UNISDR, 2003). Wiles, Bennett & Devine (2019) defined risk communication as a core function that uses risk perception knowledge to tailor information about a risk for a specific audience to enhance understanding of risks and benefit, while stakeholder engagement is a broader function that involves building and sustaining relationships with involved and interested groups through providing opportunities for participation in decision-making processes. Moreover, effective risk communication and management is dependent on other factors to contextualize the most appropriate information (Comfort, 2007; Comfort, *et al.*, 1999). One significant factor to consider is the role of the structures, policies, and coordination in dealing with risk communication and how it affects risk reduction initiatives and implementation (Comfort & Kapucu, 2006; Comfort, *et al.*, 2004; Comfort, Ko & Zagorecki, 2004; Comfort, 2007). Meanwhile, social scientists consider risk based on its perceptions is an invaluable concept in understanding and analyzing peoples' behavior when confronted with hazards and disasters (Paek & Hove, 2017).

Sheppard, Janoske & Liu (2012) stated that risk communication definitions are often similar to Covello's (1992) "the process of exchanging information among interested parties about the nature, magnitude, significance or control of risk." However, they also highlighted other definitions that emphasized the importance of risk management (McComas, 2006), the need for dialogue between communicators and stakeholders (Palenchar, 2008) and necessity of ongoing risk monitoring (Coombs & Holladay, 2010). Thus, risk communication plays a vital role in the event phases of preparedness, response, and recovery during disasters.

Risk perception, on the other hand, refers to people's subjective judgements about the likelihood of negative occurrences such as injury, illness, disease, and death which is important in health and risk communication since it determines hazards people care about and how they deal with them. Its dimension covers the cognitive level which relates how much people know about and understand and the emotional dimension which relates to how they feel about them. As such, experts base risk perception more on research findings and statistical evidence (Paek & Hove, 2017).

Scherer and Cho (2003) viewed that risk and the perception of risk are imbedded in the social context. Risk is experienced, and risk perception developed from interaction between individuals and within groups. Relator (2016) discussed that Langford and McDonald in 1997 stressed that the construction of individual risk perception is ever evolving and continually changing as long as new risk information arises. Furthermore, risk perceptions are anchored by risk experience that enables one to view risks as positive or negative. Lack of knowledge and experiences of risks could amplify the distortions and affects the cognitive ability to actions to prepare and think for possible solutions. Furthermore, Wachinger and Renn (2010) stated that perception of risk involves the process of collecting, selecting and interpreting signals about uncertain impacts of events, activities or technologies. These signals can refer to direct observation or information from others. Thus, perceptions may differ depending on the type of risk, the risk context, the personality of the individual and the social context. Risk in the social context, thus, would refer to the possibility of an effect that would result to the implementation of plans from a decision-making process of people involved (Wang, *et al.*, 2018; O'Neill, *et al.*, 2016). Moreover, Villanueva (2016) stressed that different people have different beliefs, perceptions, and experiences regarding natural disasters, specifically, flooding. Furthermore, information is a vital form in itself: disaster affected people need information as much as other basic necessities (Wamil, 2010). Thus, risk information should be given equal importance when addressing awareness and preparedness for disasters (Terpstra, Lindell & Gutteling, 2009; Rollason, *et al.*, 2018; Okada & Matsuda, 2005). However, Martin, *et al.* (2009) argued that the more risk perceptions are increased, the most likely people would adopt risk



mitigation behaviors to protect their property and themselves; and that actual experiences did not have significant impact on risk perceptions. This is contrary to the disaster experiences in the Philippines which have tremendously influenced risk perceptions and attention to preparedness (David, *et al.* 2010; Dela Cruz, *et al.*, 2010; Garcia, 2010; Magalang, 2010; Saño, 2010; Villanueva & Aid, 2010; Estacio, 2013; Sanchez & Sumaylo, 2015; Leelawat, *et al.*, 2015; Mercado, 2016; Villanueva, 2016). Another factor that may influence risk perception is personal belief, Garcia (2010) noted that some indigenous communities in the Philippines perceive that risks of disaster can be by observing unusual behaviors of animals in the environment.

Slovic (1987) looked at risk as the judgement of people about acceptability or ignore risks as influenced by risk knowledge on personal experience, attitudes and feelings of people to be affected by the event. Thus, studies of risk perception examine judgements of people make when they are asked to characterize and evaluate hazardous activities and technologies. Hence, this aims to aid risk analysis and policy-making by anticipating public responses to hazards and improve communication of risk information among the lay people, technical experts and decision makers. Moreover, people's adoption of risk mitigation strategies is influenced by the perceived degree of certainty of anticipated outcomes (Slovic, 1987), stressing the role of risk perception on stronger behavioral intention towards acting to disasters and climate change and reinforcing the link between perception and actual behaviors to reduce impacts of disasters (O'Connor, Bord & Fisher, 1999; Vin Hung, Shaw & Kobayashi, 2007; Bera & Danek, 2018; Baan & Klijn, 2004). This translates into people's tendency to act upon the risks of flooding when they have actually observed or experienced the risk event.

Social vulnerability refers to the characteristics of a person or group in terms of their capacity to anticipate, cope with, resist and recovery from the impact of a natural disaster with the indicators of income, access to basic services, access to social protection, attitude and culture to risk or disasters and social capital (Wisner *et al.*, 2004 as cited in Wisner, Gaillard & Kelman, 2012).

Studies on risk communication and vulnerabilities emphasize the role of the social capacities to anticipate, cope with, resist and recover from the impact of a natural hazard (Wisner, *et al.*, 2004 as cited in Wisner, Gaillard & Kelman, 2012); reduction of social vulnerabilities towards community resilience (Alexander, 2012); as well as the susceptibility of social groups and networks to potential losses from hazard events (Blaikie, *et al.*, 1994; Hewitt, 1977 as cited in Mendes-Victor & Goncalves, 2012). Furthermore, Mendes-Victor & Goncalves (2012) stressed that there are three main research directions on social vulnerability: (1) based on exposure model to identify conditions that make people and places vulnerable to hazards like the studies of Burton *et al.* in 1993 and Anderson in 2000; (2) measure of social resistance or resilience to hazards is associated with the assumption that

vulnerability is a social condition similar to the studies of Blaikie, *et al.* in 1994 and Hewitt in 1997; (3) integrated potential exposures and social resilience with specific focus in particular places or regions such as studies by Kaspersen *et al.* in 1995 and Cutter, *et al.* in 2000 and 2010.

## ***2.2. Resilience, vulnerability and the role of communities to reduce vulnerabilities***

Literature reveals that there is a link between resilience and reducing vulnerability (Badri, *et al.*, 2006; Balang, 2010; David, 2010; Garcia, 2010; Bene, *et al.*, 2012; Gall, 2013). 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, Okada & Comfort, 2014; Carrasco, Ochiai & Okazaki, 2016; Tselios & Tompkins, 2017).

A focus that neglects to enhance capacity-building and resilience as a prerequisite for managing climate change risks will, in all likelihood, do little to reduce vulnerability to those risks (O'Brien, Keefe, Rose and Wisner, 2006). Reducing vulnerability is a key aspect of reducing climate change risk. To do so requires a new approach to climate change risk and a change in institutional structures and relationships. Experiences with impact of disaster across the Globe tell us that the poor are the most affected and vulnerable groups. Not only are poor women, men, children and elderly being more prone to disasters, their conditions are made even worse as a result where the consequent is the increase in vulnerability. Hence, there is a need to increase “resiliency” as the desired outcome of DRR. Lindell & Perry (2004) stressed that it is important to recognize that vulnerability analysis is vital to the function and effective implementation of DRM in the areas of mitigation, preparedness, response and recovery. Thus, may provide significant contribution in structuring risk communication in the context of the identified vulnerabilities. Moreover, it should be a process by which all stakeholders must participate thereby examining the social processes that determine who receives the risk information, the social-psychological processes by information sources and receivers interact, the cognitive processes by which people interpret risk information and the cultural context that influences response and behavior toward the risk event.

The Integrated Research on Disaster Risk (IRDR) has reported that Prof. Birkmann presented to diplomats, UN officials and scientists in a 2016 New York event that the 2015 Global Risk Index has revealed that the Philippines has been ranked 3<sup>rd</sup> but managed to slightly reduce the lack of adaptive capacity and susceptibility. Similarly, Esquire, Philippines in 2018 highlighted that this rank has been observed for the third year in a row. This was far from the 10<sup>th</sup> rank in the 2007 Global Risk



Index according to Harneling in 2008 (as cited in Dela Cruz, Ferrer & Pagaduan, 2010). Consequently, over the past decade, it has been considered as one of the most vulnerable countries in the world due to the occurrence of recent severe disasters brought about by typhoons *Pablo*, *Sendong*, *Yolanda*, *Ondoy* and *Lando* that have left a great impact to the local communities in the Philippines. However, it was observed that a limited literature focused on a community-based and “localized” communication system to address a more proactive, context-specific approach on risk communication, specifically, on flood vulnerable communities.

The recent findings on risk reduction strategies have emphasized the significant role of communities in building its resilience toward disasters, including flooding. However, a big part of these strategies is affected greatly by the existing policies and governance. Policy leaders and lawmakers should regularly review and update existing policies to address gaps and promote effective community engagement (Cayamanda & Lopez, 2018). Moreover, the 2005 report from the Asian Urban Disaster Mitigation Program revealed that community-based approaches to disaster mitigation (CBDM) has been found to be aggressively introduced in Asian countries considered to be “disaster-prone” to transform at-risk communities into disaster resilient communities. It compiled reports from the different communities adopting a “bottom-up” approach in disaster preparedness and mitigation, specifically, in Cambodia, Nepal; Philippines; Bangladesh; Sri Lanka; Kathmandu; and, Patanka Village. In all these initiatives, these reports show that communication plays a significant role in building the community’s confidence and encouraging its residents to participate. It also reveals that ownership and accountability has ensured sustainability of these actions (Victoria, ND).

### ***2.3. Analytical Frameworks of the Study***

Kasperson, *et al.* (1988) states that the Social Amplification of Risk Framework (SARF) is a phenomenon by which information processes, institutional structures, social group behavior and individual response shape the social experience of risk, thereby contributing to risk consequences. It viewed hazards interact with psychological, social, institutional, and cultural processes in ways that may amplify or attenuate public responses to the risk or the risk event. Amplification occurs at two stages: in the transfer of information about the risk, and in the response mechanisms of the society. Signals about the risk are processed by individuals and social amplification stations, including the scientists who communicates the risk assessment, the news media, cultural groups, interpersonal networks and others. Key steps of amplification can be identified at each stage. The amplified risk

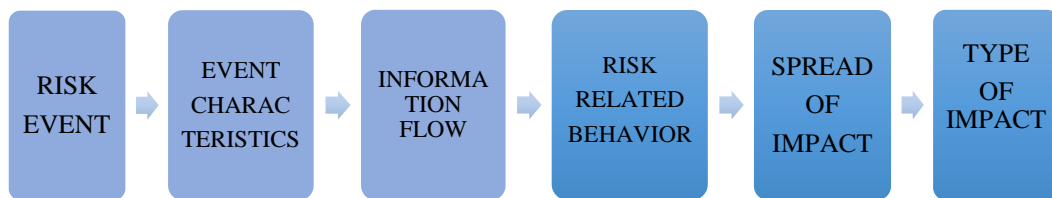


leads to behavioral responses that in turn result to secondary impact. The framework explains why and how certain risks attract public concern and become either heightened (through amplification process) or lessened (through attenuation process). Greiving, Fleischhauer & Luckenkotter (2006) regarded this framework as an integrative framework that captures risk perception (Duckett & Busby, 2013) and social systems (Oinas-Kukkonen, Lyytinen & Yoo, 2010) which examine public risk perception.

Figure 1 shows the amplification process starting with the risk event, that is, flooding in urban area. Its characteristics captured in communication messages and relayed to the target audience through the agencies and persons involved specifically those in authority. The communication signals will then form into messages transmitted to a specific target audience where receivers will respond to the risk information. These will now transform into “amplification stations” through communication and elicit responses. Ripple effect happens as the impact spreads to different groups, thus, creates a wider area of coverage. Finally, different types of impact can be the outcome of the amplification.

**Figure 1**

***Social Amplification of Risk Framework***



*Source: Kasperson, et al. (1988)*

Communication theorists introduced Kasperson *et al.*'s (1988) Social Amplification of Risk Framework (SARF) based on the concept that risk communication is usually developed by experts and hazards interact with the psychological, social, institutional and cultural processes that may amplify public responses to the risk/risk event (Comrie, *et al.*, 2019; Kasperson, 2001). Thus, risk perception influences risk-related behaviors, hence, amplified risk leads to behavioral response (Hocke-Mirzashvili, 2016; Machlis & Rosa, 1990). This framework, therefore, links the technical to psychological, sociological and cultural perspectives to highlight the “gaps” (Kasperson, 1986). The Social amplification of risk framework (SARF) has been used and adopted by many studies and 1076 citations have been reported through Crossref (Kasperson, *et al.*, 1988). Significantly, these studies found SARF to be useful in analyzing risks which systematically integrates risk assessment with the psychological, sociological, and cultural perspectives of risk perception and risk-related behavior.

On the other hand, SARF also acknowledges that there are interdependent factors that predict the risk-related behaviors such as physical consequence of the risk event, amount of amplification, risk perception, socio-economic and political impacts which links risk perception to social response and that these are strongly related to exposure to risk than the magnitude of its physical impact (Renn, *et. al.*, 1992; Relator, 2016; Comrie, *et al.*, 2019). Moreover, the framework is also useful in analyzing how the social amplification of risk shaped risk perception of flood-prone communities in Taiwan (Chiang, 2017) as well as the significant role of social amplification in strengthening resilience among retailers in urban industries in flood-prone communities in the riverbank region of Kaohsiung City (Ling & Chiang, 2018)

One particular study which directly related to this study is the utilization of SARF in analyzing Hurricane Katrina and Hurricane Rita (Hocke-Mirzashvili, 2016). The study looked into the entire disaster event to evaluate the disaster management process. The researcher described and analyzed the transmission of information through amplification stations highlighting the risk information based on the experiences, risk perception and the utilization of the filtering stations and its strategies as well as the response mechanism analyzing the role of the institutions (LGUs and other agencies involved); role of the actors (city officials and emergency planners); the existing risk communication and its operationalization (channels, medium, messages) as well as the role of the community (experiences, preparedness and behavior). They employed the qualitative approach of Case Study using the method of interviews and content analysis of the reports. Results of the study revealed that SARF was able to show the integrative analysis and provided significant results for the improvement of the systems.

This study investigates the flooding of Davao City guided by the social amplification of risk framework of Kasperson, *et.al.* (1988). **Risk events** were described utilizing the primary and secondary data reflecting the experiences and vulnerabilities of the communities to flooding.

The **analysis of the vulnerability characteristics** is based on the socio-demographic factors of the respondents reflecting the actual years of stay in the community, the structure and ownership of their houses. **Risk perception analysis** however, was correlated with their flooding experiences in terms of frequency of flooding, depth of water level in feet, perceived causes of flooding as well as the effects to the community. **Disaster Risk Management** was examined through the lens of the vulnerabilities and perception of flood-risk.

### 3. Methodology

#### 3.1. Research and Sampling Design

This study used the mixed method design, the Convergent Parallel Design in particular, an approach using both quantitative and qualitative data collection techniques, analyze separately and then merge for comparative or integrative discussion and interpretation (Creswell and Creswell, 2018). The study is both descriptive and formative utilizing both qualitative methods such as document reviews, content analysis, system analysis, Key Informant Interviews (KIIs) and Focus Group Discussions (FGDs) and the survey as its quantitative method. A multi-stage cluster sampling was employed in the survey and was conducted among the top five (5) flood prone barangays identified by the Davao City Risk Reduction and Management Center with a total population of 6177. Employing a multi-stage cluster sampling and Slovin's formula, with a 95% confidence level and .05 confidence interval, a sample population of 376 household respondents was identified. Data analysis was observed to summarize the big amount of information from the survey questionnaires and translated into quantitative measures of interpretation. The following methodologies were employed: descriptive statistics included frequency distribution, graphs, and computation of mean whenever applicable. Meanwhile, inferential statistics using Spearman's Rank Correlation was used in determining the relationship between the respondents' socio-demographic characteristics and their risk perception. The survey was conducted in the months of November 2017 to February 2018. Instead of a self-administered survey, an enumerator was sought to assist the researcher in the house-to-house survey to ensure open ended questions will be addressed. Moreover, a triangulation was done by conducting follow-up Focus Group Discussions (FGDs) among the residents of the flood vulnerable areas. The selection of the participants, however, was decided by the zonal leaders (*purok leaders*), hence, this set of participants does not necessarily involve all the respondents of the survey. In addition, since the researcher is not a native speaker of the dialect, the conduct of the FGDs were assisted by a facilitator to allow open and free discussions among participants. Consequently, the facilitator also transcribed the FGD proceedings with English translations.

### ***3.2. Locale of the Study***

This study was conducted in Davao City, considered as one of the largest cities in the world with an area of 244,000 hectares covering eight percent of the land area of the Southern Mindanao region (DC-OCPD Manual). The entire land area of the city primarily drains itself towards the Gulf Davao River and the Talomo River, the two rivers considered as the most important river basins in the city (Estacio, 2013). In addition, the disaster vulnerability of some areas in Davao City reflects that majority of the barangays are vulnerable to flooding incidents (Figure 2).



Figure 2

Davao City Hazard map

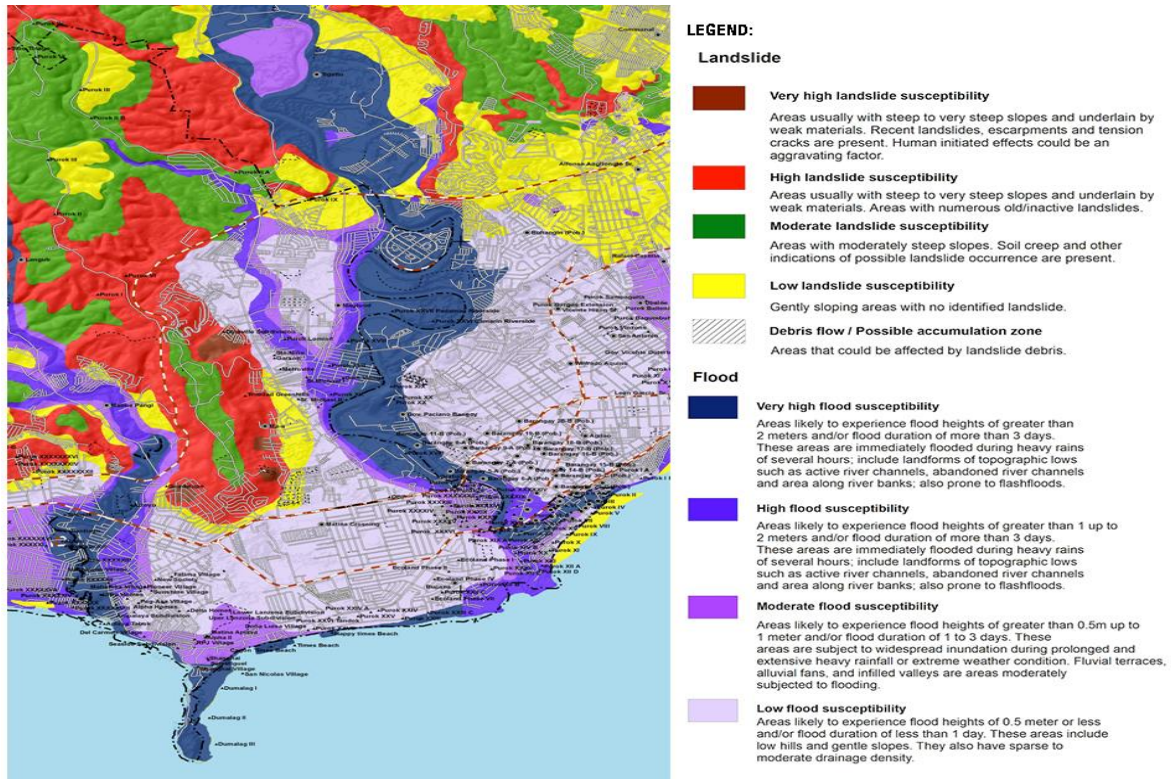
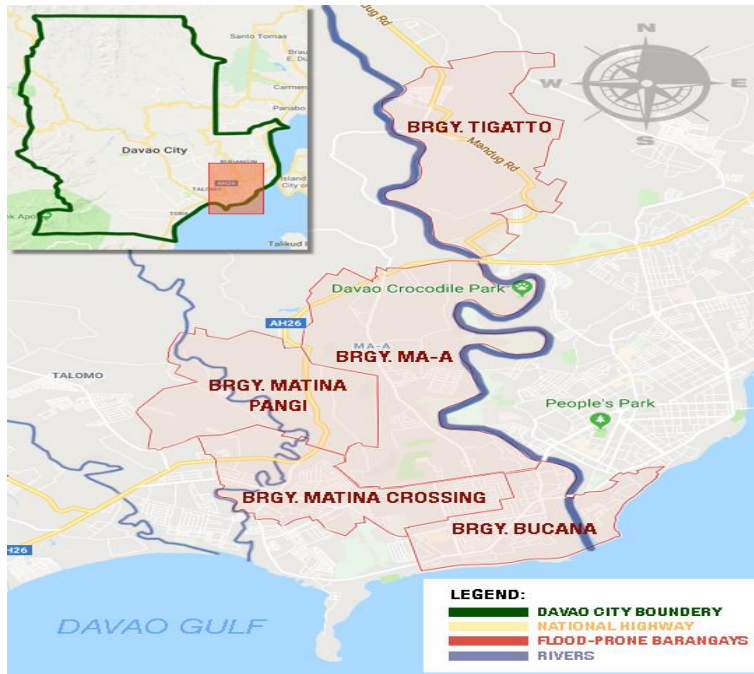


Figure 3

Location map of the research locale



Since the Davao river is one of the seven catchments which has the largest catchments area of about 1,647 square kilometers, during heavy down pour, especially in the upland areas, the river overflows. Davao City has a total of 182 barangays, of which 63 have been identified as the flood-prone areas by the Davao City's Disaster Risk and Reduction Management Council (DCDRRMC). Although the records will show that flooding and landslides have been a repeated occurrence in Davao City (DCDRRMO Report, 2011), the flashflood of 2011 in the areas of Matina, Davao City, has created an impact that shows the need for a policy challenge on the disaster preparedness and response at the community level. Figure 3 shows the location map of the research locale.

The locale of this study, therefore, was identified using a multi-level purposive sampling using the flood-vulnerability of the community as a major criterion. First, was the identification of the most vulnerable barangays to flooding based on the hazard map of the city and the affirmation by the Offices of the City Planning and Development and the Public Safety and Security Command Center (PSSCC) as well as the City Disaster Risk Reduction and Management Office (CDRRMO). These include the communities living in Matina Crossing, Matina Pangi, Bucana, Tigatto and Ma-a. The areas are classified as the top 5 flood-prone areas and consisted of both minor and major commercial zones characterized by presence of small, medium and large commercial establishments. 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 (CDRRMO Reports).

### 3.3. Data Analysis

Qualitative data were analyzed using themes. Meanwhile, quantitative data obtained from the survey of residents of the flood vulnerable communities were analyzed using the Microsoft Excel for descriptive analysis while R software was used for inferential statistics. Descriptive statistics included frequency distribution, graphs, and computation of mean, whenever applicable. Meanwhile inferential statistics using Spearman's Rank Correlation was used in determining the relationship between the respondents' socio-demographic characteristics and their risk-related behavior.

Furthermore, the study utilized the integrated frameworks of Social Amplification of Risk Framework (SARF) (Kasperson, *et. al.*, 1988) and Disaster Risk Management cycle (Khan, *et. al.*, 2008). SARF is based on the concept that risk communication is usually developed by experts and



hazards interact with the psychological, social, institutional and cultural processes that may amplify public responses to the risk/risk event. Thus, risk perception influences risk-related behaviors, hence, amplified risk leads to behavioral response. Similarly, gaps in risk communication leads to gaps in risk perception translated into deficiencies in disaster preparedness and adaptation strategies (Slovic, 1987; Wisner, Gaillard & Kelman, 2012). This framework, therefore, links the technical to psychological, sociological and cultural perspectives to highlight the “gaps”. Accordingly, messages or signals about risk travel from individual amplification stations to another. The manner in which these amplification stations follows the key amplification steps and uses informational mechanisms will determine the secondary and third order impacts of the risk information and the response mechanisms of individuals or groups. Kasperson, *et al* (1988) viewed that hazards interact with psychological, social, institutional, and cultural processes in ways that may amplify or attenuate public responses to the risk or the risk event. Amplification occurs at two stages: in the transfer of information about the risk, and in the response mechanisms of the society. The transmission of different signals in social amplification does not completely follow the traditional sender-message-receiver communication models. Social amplification deals more on the symbolic interactions although it still uses the sender-receiver model as its reference in the communication process.

## 4. Findings and Discussion

### 4.1. Vulnerability Profile of Respondents

4.1.1. Socio-demographic and Economic Characteristics. Demographic, social, and economic characteristics are the most common characteristics to describe the respondents’ vulnerability to flooding (Rufat, *et al.*, 2015). For this study, the collected demographic and social indicators included age, gender, and civil status and educational status of the respondents and their household members, and religious affiliation. On the other hand, economic factors included gross monthly income and number of household members engaged in economic activities. To further illustrate the vulnerability of the respondents to flooding; information on the number of years residing in the area and housing characteristics were collected.

Table 1 shows the profile of the survey respondents based on their socio-demographic data. The age of the respondents was categorized into four categories as young (ages 21 and below); middle age (ages 22-45) old (ages 46-60) and senior citizens (above 60 years old) based on the age classification index of the National Economic and Development Authority (NEDA) (2017). More than half of the respondents belong to the middle-aged group (53.5%); followed by the old group (39.9%). More than 80% of the respondents are females and majority have attended high school, are married, and are Roman Catholics. Although not indicated in the Table 1, it is worth mentioning that 5.1% of the

households have senior citizens and children below five years old. Wisner, Gaillard & Kelman (2012) noted that the underlying causes of vulnerability are economic, environmental, demographic and political processes which account for insecure conditions. Studies have emphasized that it has been well established that vulnerable groups or “at risk” groups are likely to be prepared for a natural disaster, more susceptible during its occurrence (CSSP, 2008; Mallon, *et al.*, 2013; Stough, 2015; Wisner, *et al.*, 2003 as cited in Howard, *et al.*, 2017).

**Table 1**

*Distribution of respondents by vulnerability characteristics*

CHARACTERISTICS	F	%	CHARACTERISTICS	F	%
<b>AGE GROUP</b>			<b>SEX</b>		
Young	5	1.4	Female	285	80.7
Middle-aged	189	53.5	Male	68	19.3
Old	141	39.9	<b>RELIGION</b>		
Senior Citizen	18	5.1	Roman Catholic	239	67.7
<b>EDUCATIONAL ATTAINMENT</b>			Islam	32	9.1
None	3	0.8	Others (includes Protestants, Adventists, etc.)	82	23.2
Elementary	67	19	<b>OCCUPATION</b>		
High School	187	53	Contractual employee	175	49.6
College	81	22.9	Self-employed	90	25.5
Vocational	15	4.2	Private employee	18	5.1
<b>CIVIL STATUS</b>			Government employee	12	3.4
Single	27	7.6	Not employed	58	16.4
Married	223	63.2	<b>Gross Household Monthly Income</b>		
Live-in	55	15.6	10,000 and below	185	52.4
Widower	37	10.5	Above 10,000 – 30,000	154	43.6
Separated	11	3.1	Above 30,000 – 70,000	8	2.3
			Above 70,000 – 140,000	6	1.7

According to Perez (2016), the vulnerability to flooding of these communities was attributed mainly to the four watershed systems in the City of Davao, namely: 1) Davao River Basin; 2) Lasang Watershed; 3) Lipadas Watershed; 4) Talomo Watershed. The other causes of flooding were high concentration of informal settlers in the vicinity, some of whom have built structures that block the drainage outlets leading to the rivers (Carillo 2015), mounting garbage (Revita 2018). Table 2 reflects the number of years residing in the area and the housing characteristics of the residents. On the average, the respondents have been staying in the flood vulnerable communities for 13 years. More than a third of respondents have been exposed to flooding for 10 years or less while another 33% are living in the area for the past 20 years.



**Table 2***Distribution of respondents by years of residence and housing characteristics*

<b>Years of residence in the area</b>	<b>F</b>	<b>%</b>	<b>House Type</b>	<b>F</b>	<b>%</b>
0-10 years	127	36	Improvised	223	63.2
Above 10 years to 20 years	115	32.6	Single One storey	69	19.5
Above 20 years to 30 years	57	16.1	Single Two-storey house	53	15
Above 30 years to 40 years	28	7.9	Attached row house/apartment	8	2.2
Above 40 years to 50 years	17	4.8			
Above 50 years to 60 years	9	2.5			
Mean Number of Years Residing in the Area - 13					
<b>Ownership</b>			<b>House material</b>		
Owned	208	58.9	Mixed materials	249	70.5
Rent-free	94	26.6	Concrete	64	18.1
Rented	51	14.4	Wood	18	5.1
			Light materials (amakan)	22	6.2

Flooding has become a natural occurrence in Davao City after 1916. After the devastating flashflood on June 2011, flooding occurred every other two years, that is, 2013 (Figueroa 2019), 2015 (Carrillo 2015), until 2017 (Figueroa 2019) when flooding happened in 2018 (Revita 2018). Figueroa (2019) reported that the effect of the flashflood in 2011 was in no comparison to the two destructive prewar floods that devastated Davao region a century earlier, one in 1912 and another in 1916. These were the most destructive ever to sink the town of Davao, destroying Davao Bridge, and leveling the roads and abaca plantations of Lapanday and Tigatto, which are situated close to the Davao River banks (Figueroa, 2019). Table 2 also shows that majority of the respondents owned (58.9%), improvised housing (63.2%) made of temporary mixed materials plywood, corrugated metal, sheets of plastic, and cardboard boxes (70.5%). Only 18% are made of concrete or permanent materials.

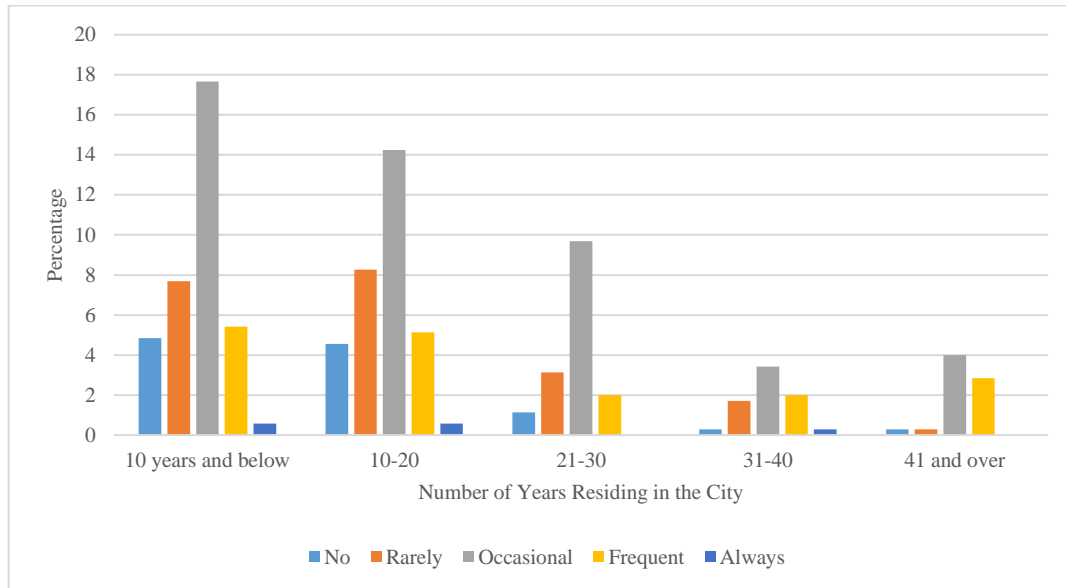
4.1.2. Flooding experiences. Risk perception on flooding, on the other hand has been attributed to the flooding experiences of the communities. The experience in terms of depth of flooding and its causes, effects of flooding, and their response on flooding. Figure 4 shows the distribution of respondents by years of residence and by flooding experience. The percentage of respondents who reported to have experienced flooding is higher for the respondents who resided in the area for the last 30 years. This is particularly true for those who reported to have experienced flooding occasionally and always. The residents of city for more than 40 years have also indicated the occasional and frequent occurrence of flooding. Reports of flooding can be considered as occasional because flooding occurs only once every year and rarely twice a year as reported by Revita (2018). Flooding occurrences in Davao City as reported by the majority of respondents are occasional but heavy. Moreover, heavy flooding occurs in the last 20 years.





**Figure 4.**

*Percentage distribution of respondents by number of years residing in the area and the occurrence of flooding*

**Table 3**

*Distribution of respondents by frequency, depth and cause of flooding*

ITEM	FREQUENCY	PERCENTAGE
Frequency of Flooding		
Always	5	1.00
Frequently	61	17.00
Occasionally	172	49.00
Rarely	74	21.00
No experience	41	11.60
Depth of flood water		
More than 4 ft.	208	58.90
2-4 ft.	31	8.78
1-2 ft.	59	16.70
Less than 1 ft.	16	4.50
No experience	41	11.60
Perceived causes associated with flooding		
When it rains/rainy season	202	57.22
Overflowing of Davao rivers	128	36.26
Obstructions in drainage system	82	23.23
High Tide	48	13.60
Strong typhoons	34	9.63
Climate Change	10	2.83
Poor urban planning	8	2.67

Table 3 contains the recollection of the respondents of their experiences with flooding highlighting the frequency of incidents, the depth of flooding, and the damages brought by flooding.



Majority (88%) of the respondents recalled that they have experienced flooding in their area of residence while 11.6% responded that they have not experienced flooding. The respondents who have not experienced flooding are those residents of the flood vulnerable communities for less than a year. Meanwhile, almost one-half of the respondents reported to have experienced occasional flooding. Only one percent of the respondents recounted to have always experienced flooding in their residence. More than half of the respondents have experienced more than four feet deep floodwaters while 18.8% have recalled experiencing a 1-2 foot depth, 10% reported a 2-4 foot depth, and 4.5% of the respondents declared less than a foot depth.

Revita (2018) reported that floodwater in the Panacan area reached waist-deep while in the lowest portion of the posh village of Belisario Heights the floodwater was at neck-level on May 29, 2018 after a heavy downpour. In terms of the perceived causes of flooding, more than 40% of the respondents associated flooding to rains. Only 6.60% reported that flooding was due typhoon. As noted earlier, Davao City is a typhoon-free area, hence it is not surprising the low number of respondents relating flooding to typhoons. This is supported by the recollection of some respondents that some occurrences of flooding are not usually experienced during heavy rainfall. The other reasons given for the flooding incidents were downpour in the upland areas which contributed to the overflowing of Davao river, high tide, and obstructions in the drainage system due to the piles of garbage in their areas. They also associated flooding as an effect of climate change and poor urban planning. These causes of flooding were also reported in several newspaper articles including Basa (2017), Carillo (2015), Revita (2018), Figueroa (2019). The report of the Bank of the Philippine Island, Inc. and WWF (2013) highlighted the rapid increase in population of Davao City which has been ongoing for the past 20 years where more than 692,000 new residents were added to the city. Davao City registered 2.88% annual population growth rate which is twice higher than the population growth rate of the Philippines between 2000 and 2005. UCANEWS (2011) quoting a key respondent, however, had a very different explanation who said that “years of environmental plunder through logging, large-scale and open-pit mining, land use conversion, to name a few, has brought us an environmental crisis.”

#### 4.2. Risk Perception of Flooding

The perception and acceptance of risks depends on the socio-cultural context, the characteristics of risk, the degree of exposure, the degree of control mechanisms and the effect of the risk on the individual or community. Thus, it also follows that resident of flood vulnerable communities’ associate risk of flooding with the possible effect of flooding to their properties, livelihood and the inconvenience of evacuation rather than the threat of high water levels (Baan and Klijn, 2004). Moreover, Bubeck, Botzen, and Aerts (2012) viewed that experience with hazards is

often considered to have a powerful impact on the recognition of a risk and seems to be an important factor that influences private mitigation behavior based on a number of studies. According to Kreiback, *et al.*, (2011), on the other hand, viewed that experience in extreme flood event significantly increases the level of preparedness among both the private households and businesses.

This study revealed that the residents of the flood vulnerable communities associate flood risks with their perception of the possible causes of flooding. This is similar to the findings of Bubeck, Botzen and Aerts (2012) that risk perception and experiences, in the context of flood risk communication and management reveal that people living in the flood-vulnerable communities often highlights their experiences as basis for their responses to flooding incidences and accepts the reality that their risk perception is directly a product of their experiences. On the other hand, Demeritt and Nobert (2014) noted that some studies revealed that social class and education are strongly correlated with higher levels of risk perception and responses to flooding as well as prior experiences on flooding as also often claimed to increase responses to risk communication messages, hence, there is a need to consider a risk instrument model (RIM) that would explicitly show risk communication as an instrument for changing attitudes and behavior among recipients; while O'Sullivan *et al* (2012) revealed that experiences on flooding motivates preparedness adaptations. Thus, emphasizing that risk perceptions are greatly affected by experiences.

Table 4 shows the risk perception on flooding among the respondents of flood-vulnerable communities. The respondents were asked if they Strongly Disagree, Disagree, Neither Agree nor Disagree, Agree, Strongly Agree and No Answer. These levels of perception were represented numerically using a scale of 1 to 5 with 5 as Strongly Agree. The findings suggest that the respondents do not see their activities to be contributing to the risk of flooding but is caused by nature as evidenced by the high percentage of respondents who strongly agreed that flooding is due to climate change (93.77%), rain (63.53%), and the fact that some areas are really flood vulnerable (56.09%).

Moreover, the respondents point out the other factors when they strongly agreed is a consequence of poor drainage system (75%) and poor urban planning (48.86%). It should be noted that 71.88% of the respondents strongly agreed on the statement “Our community is already ‘immune’ with flooding”. This has ramification on how they initiate activities to mitigate the risks of flooding and on their awareness and acknowledgement, termed as reception throughout the study, on the efforts of the local government unit to address the risks before, during, and after flooding.



**Table 4***Distribution of respondents by risk perception of flooding*

<b>Risk Perception Statements</b>	<b>Strongly Disagree</b>	<b>Dis-Agree</b>	<b>Neither Disagree Or Agree</b>	<b>Agree</b>	<b>Strongly Agree</b>
It is a normal effect of rain.	5.70	13.96	13.96	2.85	63.53
Flooding is an effect of climate change.	0.28	1.42	3.12	1.42	93.77
There are areas that are really flood-prone.	9.07	5.38	26.63	2.83	56.09
Our community is already “immune” with flooding.	5.40	9.66	11.65	1.42	71.88
Flooding is a result of poor urban planning.	15.91	7.67	24.72	2.84	48.86
Flooding is a consequence of poor drainage system	8.52	5.97	8.52	1.99	75.00

#### 4.3. Risk perception and experiences in flooding towards reduction of vulnerability

Results of the focus group discussions (FGDs) reveal that many of the participants admitted being aware of the risks of flooding and accepted the fact that they live in the flood vulnerable areas are willing to relocate. However, the high cost of moving and losing their current livelihood deter them from moving out of their flood vulnerable community. According to them, they resorted to reducing their vulnerabilities by closely monitoring the weather in the uplands through radio or local updates from the television; placing sticks on the riverbeds to see the increase in the water level, and closely coordinating with the barangay officials. Thus, the need to strengthen promote participatory engagement to come up with localized strategies in disaster preparedness and management in flood vulnerable areas (Cayamanda & Lopez, 2018). The responses during the FGD reveal that experiences in flooding in Davao City started as early as 1966 and participants have recollection of high tide experience in 2002, significant flooding incidences such as the Matina flashflood in 2011, Maa flooding in 2013, and the recent 2017 flooding in Bucana and Tigatto. This information confirms the survey results that the respondents have been exposed to the risks and impact of flooding, thus, highlighting convergence between the quantitative and qualitative data. Although as the survey revealed that majority of the respondents consider rainfall as the major contributory factor for flooding, through the years, it has already worsened. One particular significant response was the 2017 flooding incident in Tigatto which occurred even without the presence of any rainfall. The participants also mentioned that their response to flooding incidences can be considered as self-imposed monitoring (i.e., staying awake and alert; monitoring water levels; and voluntary evacuating PWDs, children and senior citizen of the household to higher or safer grounds) while the males took



charge in staying to watch over their property and belongings; barangay initiated such as purok leaders house to house warning and advise and reliance on the dissemination of information by word of mouth within the community.

Flood vulnerable communities' perception, attitude and behavior on flooding revealed that significant factors such as experience in flooding, its occurrences and depth as well as years in residence influence the respondents' behavior towards flooding incidences. This affirms that experiences also reinforce risk perception which is contrary to the argument that actual experiences did not have significant impact on risk perception (Martin, 2003 & Martin, *et al.*, 2009). Results of this study on perception and assessment of the risk communication affirms previous studies that: (1) different people, having different beliefs and perceptions can be bound together by experiences, in particular, flooding (Wamil, 2010); (2) there exists a link between risk perception and actual behaviors (Raude, *et al.*, 2005); (3) individual belief in risk reduction behaviors, effective and strongly-led people to actually engage in risk reduction behaviors (Martin, *et al.*, 2009; Parker, 2017; Mulilis and Duval, 2006). The experience of flood victims is only one aspect in proactive action in flood risk management (Higginbotham *et al.*, 2014). Whitmarsh (2008) argued that experiences have to be paired with individual values and belief. Therefore, individual actions can also be associated with socio-economic status of individuals (Kreibich *et al.*, 2011; Duží *et al.*, 2017; Fuchs *et al.*, 2017).

The FGDs also revealed that although majority of the participants appreciate and welcome the barangay efforts on information dissemination and preparedness about flooding, they opined that other factors contribute to their plight i.e., poor drainage system; lack of vegetation in the areas to absorb water; poor planning on location of subdivisions and residential areas. Some suggestions for the management of risk messages at the community level, specifically, a need to develop a communication management plan at the barangay levels i.e. point persons or in-charge should be clearly identified per purok for a better and more organized communication flow in the flood vulnerable communities. In so doing, there will be an opportunity for community and institutions to discuss and decide on the protocols of the inter-organization approach emphasizing the role of the institutional structures and provide the mechanisms for disaster mitigation and response that are context-specific to the communities (Christoplos, *et al.*, 2001; Comfort, Ko & Zagorecki, 2004; Comfort, 2004; Comfort and Kapucu, 2006; Comfort, 2007; Tselios and Tompkins, 2017).



## 5. Conclusion

Using the convergent parallel design method shows that majority of the quantitative results converged with the qualitative findings except on the divergence in area of the triangulation between the respondents' awareness of their community as flood-prone and willingness to relocate. However, it conforms to Mercado's (2016) finding which accounts for the economic cost of relocation and thus the decision of the residents to remain in the flood vulnerable area despite the risks and hazards associated with it.

Results of the study revealed that the vulnerability is associated with socio-demographic characteristics, experience in flooding and responses to flooding which are in consonance to the studies on risk communication that highlights awareness and preparedness and the critical role of decision-making on disaster eventualities. Specifically, flood risk communication studies have been documented highlighting the role of social networks and the different strategies to improve flood risk communication as well as looking at different perspectives to assess the flood risk communication systems towards upgrading awareness and preparedness.

As previous studies have been documented on risk perceptions, different risk communication strategies, modelling of risk studies and evaluation of risk communication, this particular study may provide additional literature on the role of community-based flood risk communication systems, particularly, in addressing the "localized" and participatory approach which evidently is not yet observed by the communication systems of Davao City.

Hence, the study concludes that the risk reduction strategies can be further enhanced through a risk communication management using a localized and participatory approach in the proper knowledge transfer of flood risk communication among the stakeholders involved. Community-based policies and well-defined communication processes must be strengthened to promote inclusive approach towards effective community-based disaster preparedness and management.

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