



Community-based Risk Communication Management

Theory and Application

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Dedication

Finally, the completion of this academic journey, I
share and offer to MY FAMILY, from and for whom I
continually exist and live a life of happiness, contentment and
pride ---

EDWIN,

AJ and Dianne,

CARLO and Sharmaine,

ERIKA,

and

my granddaughter AADI.

This is also for you....

Mama and Tita Vicky

The Ventoza and Cayamanda clans

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KJGC

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Foreword

This book should be read by everyone and anyone who needs to protect people from the vagaries of climate change that have continued to disrupt our lives. These people include intergovernmental bodies, government policymakers and the executive, the business sector, academe, civil society, local government executives, and communities on the ground – in short, you and I –, because we need to put all hands on deck to attain collective adaptivity and resilience amid climate change. Central to this collective action is risk communication at a granular level, which in totality will create individual ownership and accountability of safety against flooding occurrences.

The recommendations of this book are not only relevant to Davao City, the study site, but also to the whole country and even to other climate change-affected parts of the world.

Further disruption is going to take place globally as climate change impacts us even more through our failure to reduce greenhouse gas emissions. The Intergovernmental Panel on Climate Change said as much in the first installment of its Sixth Assessment Report released on February 28, 2022.

The report is an “atlas of human suffering and a damning indictment of failed climate leadership.” This is how UN Secretary-General Antonio Guterres wrapped up the contents of the report. Grim and chilling, the report’s projections should alert the government, business, civil society, as well as communities and families to undertake massive efforts to avert catastrophic disasters that are bound to happen as the planet continues to heat up.

While it is true that as a minor contributor to global emissions, the Philippines plays a minor role in climate change mitigation, we also suffer the most from the 20 or more typhoons that hit our country each year. Recently, these typhoons have had wider circulations, brought heavier rains, and caused flooding in larger swathes of the country. These typhoons have caused deaths and untold destruction to crops and property; and year after year, set back development in the country.

This situation calls for a granular, agile, and community-owned response to flooding that makes communication a backbone of flood risk preparedness and management. This is espoused by this book *Community-based Risk Communication Management Theory and Application*.

The *Community-based Flood-risk Communication Management (CBRFCM) Framework and Theory* proffered in this book argues for an approach to risk communication that integrates flood risk communication with the disaster management cycle. It highlights the importance of agile preparedness by the communities with community members as empowered participants who know how to protect themselves because they were involved from the onset in crafting risk reduction strategies that improve their awareness, preparation, and response to flooding incidence. The same thing we also have argued in our work on *Community Media for Social Transformation: The Missing Link for Climate Change Resilience in 2017*, which suggests that information coming from the local community must be given more space and airtime so that community members can promptly take the needed action based on their area's climate condition.

Does this shift the responsibility of risk reduction and protection from government agencies to community members? It certainly does not. It calls for the seamless

inclusion of communities to a simultaneous “top-down” and “bottom-up” and horizontal communication flow that will promote transactional communication within these communities and across boundaries toward localized and participatory risk management strategies that are incorporated into the planning process for enhanced coping mechanisms and capacities.

This calls for a risk communication management approach that integrates the current risk communication system and disaster risk reduction management approach of the national and local government unit. Such integration will close the gap in the disaster management cycle, and minimize, if not prevent, the effects of catastrophic flooding brought about by climate change not only in Davao City but also for the entire country.

In so many instances of programs being implemented, communication has been an afterthought when public relations need to be rolled out or when crisis situations need to be addressed. This book shows why and how communication should be integrated into disaster risk reduction management. With the increasing incidence of flooding, it’s time to heed the clarion call.

Mark Lester M. Chico

Assistant Professor 7

UPLB Department of Development Broadcasting & Telecommunication

Director, UPLB Office of Public Relations

President, Philippine Association of Communication Educators

Preface

This book project has been an opportunity to share the plight of the flood-vulnerable communities of Davao City, Philippines. Aside from being a requirement to graduate under the PhD Development Studies program, the major objective is to find ways how the academe can help in alleviating the risks of flooding as a recurring disaster in these areas.

As extensive literature on disaster studies examined risk communication and disaster risk management, it has been found to be discussed as separate concerns. These studies emphasize the significant role of risk communication and management at the level of the communities to enhance community preparedness and reduce the risks triggered by disasters like flooding. However, no literature has been found specifically in the area of risk communication management. The study, therefore, aimed to focus on this gap in the literature which integrates risk communication with disaster risk management towards a more integrative approach to risk reduction.

Using a convergent parallel mixed method design, the study was conducted utilizing both the qualitative and quantitative approaches in the data collection and analysis guided by the integrated frameworks of the disaster risk

management and the social amplification of risk (SARF). The merging of both results in the analysis and interpretation helped identify the convergence or divergence of the findings. Results of the study revealed 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, placing the community as the central actor for amplification.

This book highlights the proposed community-based flood-risk communication management (CBFRCM) framework as a modification of the SARF labeled as the Flood Risk Amplification Communication Theory (FRACT) as an alternative framework. The application of the theory necessitates the enhancement of risk communication management towards the resilience of the flood-vulnerable communities, specifically in the context of Davao City, Philippines.

The authors wish to share these findings and encourage that the proposed theory be used in other contexts and optimize the role of risk communication as part of the risk reduction approaches of risk managers and policy makers on disaster management.

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CHAPTER 1

Introduction

Stephenson (1994) stressed that development and disasters are closely linked, and disasters can both destroy development initiatives as well as create opportunities. Even as this was underscored, the cause and effect relationship between disasters and socio-economic development was not given prominence in the past. It was further observed that disasters were seen in the context of emergency response rather than as part of long-term development programming (UNISDR, 2007). Overtime, the effects of disasters can seriously degrade a country's long-term potential for sustained development and cause governments to substantially modify their economic priorities and programs (Stephenson, 1994; Stephenson & Dufrane, 2002). Similarly, Harvey (2005) emphasized that the social and economic cost of natural disasters has increased in recent years. Aside from disruption of the community's

livelihood, disasters have long-term repercussions in growth, development and poverty reduction (Benson & Clay, 2003).

The United Nations estimates that the consequent economic loss of the yearly occurrence of disasters worldwide is \$520B, and this deplete public funds that can be used to provide basic services and social protection. The Office of Civil Defense-National Disaster Risk Reduction Management Council (OCD-NDRRMC) report in 2017 revealed that the economic cost of natural disasters in the Philippines reached Php6.446B due to 22 tropical storms, flashfloods and intertropical convergence zones (Cordero, 2018). Damages caused by flashfloods was estimated at Php104,229M, excluding damages to private properties, commercial activities and foregone revenues from hundreds of lives lost as a result of the calamities.

UNISDR likewise estimated that the cost of disaster in the Philippines accounts for 0.8% of Gross Domestic Products (GDP) since the effect is mostly on production of goods and investments, translating to imbalance in payments, employment, exchange rate and inflation (Cordero, 2018). With the heightened awareness of risks, governments must make the necessary actions in developing disaster-resilient communities (Bacasmás, 2018).

The UN 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.”

Thus, disaster risk reduction (DRR) involves every part of society, every part of government, and every part of the professional and private sector (UNISDR, ND; UNISDR, 2007). Countries can build resilience to disasters through DRR, however this begins with an effective disaster risk governance in a country, and requires effective mechanism for coordination within and across sectors involved (Kerstholt et al., 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). Moreover, unsound development policies will only increase disaster risk and disaster losses.

There is an extensive body of literature on disaster management that emphasize the role of risk communication towards risk reduction (Comfort et al., 2004; Comfort et al.,

2004; Mercado, 2016; Pidgeon et al., 2003; Kasperson et al., 1988). However, studies on this aspect are mostly on addressing the different stages of the disaster management cycle, analyzing social vulnerabilities, and/or operationalizing models as intervention mechanisms. There is a gap in relevant works that investigate the integration of risk communication and disaster management, specifically on risk communication as fundamental to risk reduction. Hence, this will focus on risk communication management as an integration of risk communication and disaster management towards risk reduction strategy for flood-vulnerable communities.

Traditional approaches to risk communication are being used by disaster managers for community education (O'Neill, 2004). Using the traditional top-down approach for awareness and preparedness are useful but this may not take into consideration the context-specific risk perceptions of the community towards disasters, as well as determine the capacities of the communities to respond to these risks. There is a need to shift from an emergency response to a “proactive risk management” approach that integrates a participatory approach and community safety as a total system, with all the elements involved being integrated into the entire system. Using risk communication as a tool for effective risk management at the community-level can enhance preparedness and reduce risks triggered by flooding.

Moreover, disaster preparedness intervention is relevant at the level of communities since it has the capacity to collectively identify problems, take decisions and act on them (Allen, 2006).

The Philippines has two (2) national policies that can be referenced for disaster risk reduction management: (1) the Climate Change (CC) Act or RA 9729 of 2009, and (2) the Disaster Risk Reduction and Management (DRRM) Act or RA 10121 of 2010 (RP Gazette, 2012). These policies highlight 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. However, the barangays play a vital role in disaster risk reduction and, therefore should be empowered to initiate a 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, to capture the specific contexts of the different localities in 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.

Disaster risk reduction remains to be a challenge for everyone and requires a risk management approach (Twiggs, 2004). For one, the literature on hazards and disasters have varied technical terms and jargons. These terminologies can be classified as: (1) *disaster terminology*, referring to nature and elements of disaster. These include *disaster* (damage and disruption that affects society's capacity to cope), *hazard* (potential threat to humans and their welfare), *risk* (the likelihood of a specific hazard occurring and its probable consequences for people and property), *vulnerability* (the extent of effect of hazard related to a person, group or socio-economic structure's capacity to cope, resist or recover from its impact); and, (2) *disaster management terminology*, referring to the terms on the components of disaster management that includes *mitigation* (any action taken to minimize the extent of a disaster or potential disaster that can take place before, during or after a disaster, but the term is most often used to refer to actions against potential disasters. Mitigation measures are both physical or structural (such as flood defenses or strengthening buildings) and non-structural (such as training in disaster management, regulating land use and public education); preparedness which are specific measures taken before disasters strike, usually to forecast or warn against them, take precautions when they threaten and arrange for the appropriate response (such as organizing evacuation and

stockpiling food supplies). This falls within the broader field of mitigation; prevention is for activities to ensure that the adverse impact of hazards and related disasters is avoided. As this is unrealistic in most cases, the term is not widely used nowadays. However, the more general term being used is “disaster reduction” or “disaster risk reduction” to mean the broad development and application of policies, strategies, and practices to minimize vulnerabilities and disaster risks across society through prevention, mitigation, and preparedness. Disaster risk reduction management, on the other hand, covers the implementation of preparedness, mitigation, emergency response, and relief and recovery measures. Disaster cycle (Figure 1) and disaster management (Figure 2) models illustrate the link of these concepts with one another through diagrammatic presentations.

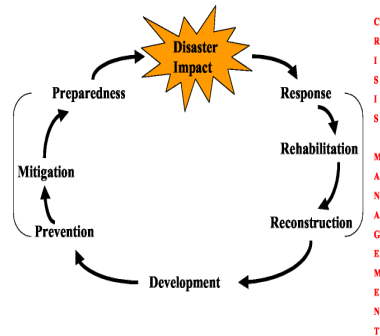
Figure 1
Disaster Management



R
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Figure 2
Disaster Management Cycle



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Disaster Risks and Development

Disasters are a major threat to development. The UNDP reports between 1992 and 2001 revealed that developing countries are hit hardest by natural disasters, including flooding (UN, 2005). The imbalance of impact between developed and developing countries is due partly to geography and the increase of economic costs of natural disasters are attributed to population growth, change in land use patterns, migration and unplanned urbanization, environmental degradation and global climate change (Harvey, 2005). Many of the developing countries, including the Philippines, are highly prone to disasters such as earthquakes, volcanic eruptions, landslides, typhoons, droughts, hurricanes and floods. Stephenson (1994) argued that effects of disasters can seriously degrade a country's long-term potential for sustained development, development requires institutional and structural transformations to speed up economic growth, reduce levels of inequality and eradicate poverty. Disaster Risk Reduction Management (DRRM) approach, therefore, must consider a systematic approach (Twigg, 2004). Incidentally, the World Bank Development Committee stressed that natural disasters can be a serious impediment to poverty reduction and affect poor and vulnerable people the most and its impact is on the rise. Disasters triggered by natural hazards are killing more people over time and costing more, a trend revealed by the data

collected by the Center for Research on the Epidemiology of Disaster (CRED) in Belgium (EM-DAT, 2005 as cited in O'Brien, Keefe, Rose & Wisner, 2006). Thus, the poorer nations are usually the most affected. As UN Secretary General Kofi Annan stated: “communities will always face natural hazards, but today’s disasters are often generated by, or at least exacerbated by, human activities” (United Nations, 2005).

Disaster risk management refers to both mitigations as minimizing effects of disasters, and preparedness as ensuring the readiness of the society to forecast, take precautionary measures and respond to impending disaster (Christoplos et al., 2001). Mainstreaming disaster risk management has been the focus of some vulnerable countries in the last decade. Bello et al. (2017) profiled five selected member states of the Caribbean Development and Cooperation Committee that includes the Bahamas, Belize, Dominican Republic, Haiti, and Jamaica looking at the national development plans and how they integrated DRM policies and climate change adaptation strategies. In Australia, climate change adaptation and risk reduction strategies are the highlight of DRM as projected in their strategies, policies and plans (Forino et al., 2017). Specifically, the Philippines, being a developing country considered as highly vulnerable to flooding has devoted efforts and initiatives to help build disaster-resilient communities through different approaches in risk reduction management

(Dela Cruz et al., 2010). Current approaches on risk reduction management specifically focused on flood risk management (Bubeck et al., 2018; Wang et al., 2018; Vin Hung et al., 2007; Baan & Frans Klijn, 2004).

Disaster Risk Reduction and Management in the Philippines

The country's high exposure to disasters is often attributed to geo-physical characteristics which predispose the country to natural hazards like strong typhoons, earthquakes or volcanic eruptions. Natural hazards leave catastrophic results when affected communities are vulnerable and do not have the capacity to cope with their physical, socio-economic and psycho-emotional impacts. (Dela Cruz et al., 2010). Thus, there is a need to uphold and implement DRR initiatives to reduce the harmful impacts of disaster to the affected community. Reducing the risks can be a better alternative to disaster rehabilitation and recovery.

In the Philippines, disaster risk reduction policies and institutional mechanisms exists, however, the effectiveness of such policies and mechanisms is considerably restricted, hence the pressing need for a strategic approach for improvement and enhancement by emphasizing DRRM Law. To address this concern, Saño (2010) documented the experience of a civil society network advocating for a national law on DRRM.

Results of the Case Study provided understanding on the significant role of stakeholders in a national policy formulation process that aimed to establish a progressive framework addressing related issues on institutional mechanisms, financing and planning. The reality that disasters, especially those induced by climate change, will be more frequent and ferocious in this and the succeeding generations, thus, requires the steadfast effort in finding new solutions and promoting proven strategies to mitigate if not prevent damaging impacts. This task is more urgent because it is the poor majority who are most at risk to these disasters, yet the least prepared and least able to cope with its consequences (Villanueva and Aid, 2010). Resilience, thus, is becoming influential in development and vulnerability reduction sectors such as social protection, disaster risk reduction, and climate change adaptation. Policy makers, donors and international development agencies are now increasingly referring to the term (Bene, et al., 2012).

To address the centrality of communication to community resilience and disaster risk reduction is the recognition of the role of the communication systems which accounts for holistic approach to communication as a complex process with its elements of Source-Message-Channel-Receiver. It involves various processes, both formal and informal, by which information is passed between the different elements using effective communication (Murphy &

Hildebrandt, 1997) and guided by communication protocols (policies and set of rules) using varied resources (media, official sources of information and communication infrastructure), community relationships (social capital, organizational linkages, communication infrastructure), strategic communication processes (community planning, storytelling and disaster response coordination) and community attributes such as flexibility, diversity and economic resources (Houston, 2018).

Disaster Risk Management and its factors

Disaster Risk Management (DRM) can be seen within a broader context of disaster risk reduction that includes different activities involving public administration, strengthening organizational and institutional development, implementing policies, strategies and coping capacities of the society to reduce negative effects of hazards (UNISDR, n.d.). As a collective term encompassing all aspects of planning for and responding to disasters, it includes both pre- and post-disaster activities. It refers to the management of both the risks and consequences of disaster (UNDP, 1991). The five pillars of DRM include: risk identification, risk reduction, preparedness, financial protection, and resilient recovery (Bello et al., 2017). Thus, there is a need to approach the issue on a holistic approach (Cardona, 2004), whereby four areas of

concerns must be addressed: disaster prevention and mitigation and disaster preparedness for the pre-disaster stage; while disaster response and disaster rehabilitation and recovery for post disaster stage (NDRRMP Manual).

The Philippines' approach in responding to climate change and disaster has been an attempt to integrate all the efforts of different agencies and build on the premise that vulnerability, hazards and capacity-building have been explored and studied. Specifically, priority 2 which states that there is a need to “strengthen disaster risk governance to manage disaster risk”. Consequently, this approach also addresses the Millennium Goal Section IV, protecting our common environment: *“To intensify collective efforts to reduce the number and effects of natural and man-made disasters* (United Nations, 2001). However, after 15 years, the Millennium Development Goal (MDG) report revealed that one of the issues that still need closer attention is the climate change and environmental degradation that undermine progress and that the poor people suffer the most. Thus, there is an urgent need for disaster management to be further enhanced and carefully planned. In so doing, whether the disaster is caused by environmental, climatic, biological, technological, geological, industrial or accident-related activities --- the new approach calls for capacity-building and 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 disaster management on disaster preparedness. Noteworthy to mention that a lot has been devoted to building shelters, evacuation areas, providing capacity through drills (Badri et al., 2006; Bene et al., 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, 2006). Moreover, studies have also 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 & Ruitenber, 2004; Fernandez & Shaw, 2013; Carcellar et al., 2011).

Dela Cruz et al. (2010) compiled the cases of some communities in the Philippines where disaster resilient communities and capacity-building initiatives have been introduced to address vulnerability reduction and social protection that may eventually lead to sustainable development. It reflects that the state of the community's capacity to face and overcome disasters is deeply affected by its physical/environmental, economic, socio-cultural and

political contexts - these factors ultimately translate into environmental degradation, people's access and control on different forms of resources and assets, inequality that led to exclusion of women, children, elderly and minority groups - all contribute significantly to shaping a community's level of resiliency or vulnerability to disaster risks (dela Cruz et al., 2010).

Similarly, studies on *Early Warning Systems* at the community levels in the Philippines have been documented. David et al. (2010) emphasized the need for a community and DRR Technology interface in the case of the Bicol River Basin II (BRB2) project. The collaborative efforts of Manila Observatory, UP-National Institute of Geological Sciences (NIGS), the COPE Foundation, Inc., Naga College Foundation, Ateneo de Naga University and University of the Philippines – College of Social Welfare and Community Development (UP-CSWCD) have paved the way to the recognition that complexities of disasters and its diverse effects on people requires a multi-disciplinary approach. For one, the project addressed the integration of Science & technology, DRR and community knowledge integration. The decentralization of the Early Warning Information involved the establishment of home-based early warning stations that did not only involved communities but also offered alternative to the top-down approach, thereby, empowering the local

communities but using a technology that can be useful to the volunteers.

In addition, there are three cases of participatory disaster-responsive governance have been initiated to enhance community-based participation. Magalang (2010) documented that in 2005, the involvement and cross-sectional approach in Marinduque of mainstreaming DRR and Climate Change Act (CCA) in the planning and budgeting process of the barangays collaborated with the church, Non-government Offices (NGOs) and the Local Government Units (LGUs). Furthermore, the barangay-based institutions like the Local Disaster Coordinating Committee's (LDCCs) have been revitalized, re-organized, strengthened and capacitated. The Case Study results show that a Systems approach at the community-level would be beneficial for all the stakeholders while empowering the community on decision-making and governance. Similarly, Balang, Jr. (2010) documented the experiences of Apas, Bulacao and Kalunasan communities in Cebu City from October 2008 to March 2009 and his study revealed that adopting a holistic approach to DRR is crucial to address the health and well-being concerns of the community who resides along the riverbanks. Ripraps can only address threats of flashfloods and landslides but other risk factors like solid waste and waste water disposal, lack of latrines among community residents, limited livelihood opportunities and

malnutrition are equally critical concerns that deepen the vulnerabilities of the community. Furthermore, a continuous communication and awareness campaign should be sustained to increase awareness and equip the community with knowledge and skills that can strengthen existing capacities.

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 (2013) emphasized that building relationship and ties is crucial for social capital to play its positive role to disaster resilience. Similarly, Zhao (2013) did a study of the role of “social networks” in reducing the risk of disasters using the case of Wenchuan earthquake in 2008. The study revealed that using a network study approach can help understand the social structure and processes involved during disasters and provided insights on how to improve the management policies and communication systems. Moreover, it 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.

Leelawat et al. (2015) has proven that information and communication in disaster management makes it necessary for those involved in the communication systems to learn and prepare both new information and utilize communication technologies and traditional media to take care of emergency situations, for instance, the power blackout in Tacloban during Typhoon Haiyan. In such crisis, portable radios have been found to be necessary to provide uninterrupted, timely and accurate information. Similarly, communication has been found to be a significant tool for risk management such as in the case of the 2011 flashflood incident in Matina, Davao City (Estacio, 2013; Sanchez & Sumaylo, 2015; Cayamanda & Lopez, 2018). The communication of information about natural hazard risks to the public is a difficult task for decision makers. Research suggests that newer forms of technology present useful options for building disaster resilience (Feldman et al., 2016).

CHAPTER 2

Flooding as a Risk Event in Urban Development

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. The role of government and financial restrictions are the two major problems that developing, and least developing countries face when managing disasters. 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 et al., 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).

Incidentally, the United Nations (2005) considered urbanization as a form of metropolitan growth that is a

response to often bewildering sets of economic, social, and political forces and to the physical geography of an area. It is the increase in the population of cities in proportion to the region's rural population. Furthermore, the 20th century is witnessing "the rapid urbanization of the world's population", as the global proportion of urban population rose dramatically from 13% (220 million) in 1900, to 29% (732 million) in 1950, to 49% (3.2 billion) in 2005 and is projected to rise to 60% (4.9 billion) by 2030. Urban ecosystems are the consequence of the intrinsic nature of humans as social beings to live together (Sudhira et al., 2003; Ramachandra et al., 2012; Ramachandra et al., 2014). The process of urbanization contributed by infrastructure initiatives, consequent population growth and migration results in the growth of villages into towns, towns into cities and cities into metros. Urbanization and urban sprawl have posed serious challenges to the decision makers in the city planning and management process involving plethora of issues like infrastructure development, traffic congestion, and basic amenities which includes electricity, water, and sanitation, among others (Kulkarni & Ramachandra, 2006).

The interplay of disaster and urban development is recognized in literatures that determine 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; Carrasco et al., 2016; Comfort et al., 1999; Mochizuki, et al., 2014). The process of urbanization contributed by infrastructure initiatives, consequent population growth and migration results in the growth of villages into towns, towns into cities and cities into metros. 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 like 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).

The International Bank of Reconstruction and Development (IBRD) 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 towns and cities in developing countries*”. Similarly, the frequency of typhoons and storms passing through the Philippine archipelago makes it more vulnerable to flooding (Magalang, 2010).

Urban flooding is considered as a risk event one of the most frequent natural disasters in the Philippines (Cayamanda & Lopez, 2018). The Intergovernmental Panel on Climate Change (IPCC) defined flood as “*the overflowing of the normal confines of a stream or other body of water, or the accumulation of water over areas that are not normally submerged. Floods include river (fluvial) floods, flash floods, urban floods, pluvial floods, sewer floods, coastal floods, and glacial lake outburst floods*”.

In addition, Ramachandra et al. (2012) discussed further that floods in an urbanized landscape refer to the partial or complete inundation from the rapid accumulation or run-off resulting in the damage to property and loss of biotic elements (including humans). Urban flooding is a consequence of increased impermeable catchments resulting in higher catchment yield in a shorter duration and flood peaks sometimes reach up to three times. Thus, flooding occurs quickly due to faster flow times (in a matter of minutes). Causal

factors include combinations of loss of pervious area in urbanizing landscapes, inadequate drainage systems, blockade due to indiscriminate disposal of solid waste and building debris, encroachment of storm water drains, housing in floodplains and natural drainage and loss of natural flood-storage sites. Flood mitigation in urban landscape entails integrated ecological approaches combining the watershed land-use planning with the regional development planning. This includes engineering measures and flood preparedness with the understanding of ecological and hydrological functions of the landscape (Ramachandra et al., 2012).

Flooding as a focus of disaster studies have been documented in different parts of the world. Kerstholt, Duijnhoven and Paton (2017) focused the case of flooding in Netherlands emphasizing the role of flooding preparedness as affected by risk perception, social participation and community efficacy. Motoyoshi (2006) looked into flooding in Japan and analyzed the relationship of flood risk perception with community-based disaster preparedness. His study revealed the factors that affect risk perception as well as factors that increase public intention to participate in community-based preparedness activities. In Chile, a study focused on Talcahuano's flooding occurrences because of intense rapid urbanization and looked at flood risk perception, vulnerability, resilience, and coping capacity concepts. The study revealed

that the public's endogenous and exogenous characteristics have resulted determinants to explain their perception (Lara et al., 2016). Similarly, in Malaysia, a mapping perception of community preparedness on flooding has been analyzed using Likert Scale and GIS and found that community engagement plays a very vital role in flooding preparedness (Asmara & Ludin, 2014). In Germany and France, flooding and coping appraisals have been analyzed using the Protection Motivation Theory (PMT) and revealed that a strong positive social environment plays a significant role and recommended that risk communication should be enhanced using the observed social norms and network effects (Bubeck et al., 2018; Bubeck et al., 2012; Bubeck et al., 2017). Moreover, studies on flood risks have revealed that trust and communication play an integral role in the effectiveness of risk communication as well as the role of the institutions and other social networks, i.e. volunteer groups, emergency services and neighbors (Seebauer & Babcicky, 2017).

CHAPTER 3

Risk Communication, Resilience and Risk Reduction

Strategies for Disaster Risk Reduction can be enhanced through effective risk communicative processes and practices and is widely regarded as a core to disaster management (Howard et al., 2017). Disaster and risk communication have been found to be a significant strategy, but careful attention must be given to its processes and systems to help improve the disaster-related outcomes. Specifically, the need to address the context of audience vulnerabilities, perception, experiences, and practices on disaster-related communication.

Samaddar et al. (2015) cited that Pearce (2003) argued that the growing literature on disaster-related communication has revealed that risk communication can be an effective tool to address the growing consensus among researchers and planners to incorporate local communities in disaster risk management and climate change adaptation planning. However, its actualization largely remains a dream.

Risk communication is a component of risk governance towards disaster mitigation, preparedness, response, and recovery. Thus, risk communication is usually aimed for making people aware of the risks; improve their knowledge on possible disasters and how they could be prepared; change their attitude towards preparation; and changing eventually their behavior. Being a core to DRRM in Georgia, a communication system was found to be useful in the areas of early warning and preparedness activities, utilizing several tools and channels as suggested by Van Westen and Kingma in 2009 (as cited in CENN, n.d.) as follows:

Risk Communication Tools	Messages	
	Early Warning	Awareness
Mass Media (TV, Radio, Newspaper)	X	X
Electronic media (WWW, SMS, MMS)	X	X
Audio-visual (video, audio, multi-media, animation, photographs, model, map, slide show, artwork, graphs)	X	X
Postal (direct mailing)		X
Stand-alone print (billboard, poster, banner, warning sign, flood water level)		X
Face-to-face (meeting, seminar, workshop, conference, march, exhibition, demonstration, training, exchange visit, planning)		X
Distributor print (leaflet, pamphlet, brochure, booklet, guideline, case study, newsletter, journal, research paper, report)		X
Folk media (story, drama, dance, song, puppet, music, street entertainment)		X
People (community leader, volunteer, project worker, head of sectoral groups, i.e. tribe, women, youth)	X	X

Meanwhile, Bradley, McFarland & Clarke in 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 in 2003, Cyclone in India in 2003 and Evacuation during wildfire in California, USA in 2007. 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 during the 2008 Wenchuan earthquake. 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, Cole and Fellows in 2008 studied hurricane Katrina and explored the “inadequacies” of the risk communication based on Lundgren and McMakin (2004) and Rowan’s (1977) 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.

Disaster policy response to climate change is dependent on a number of factors, such as readiness to accept the reality of climate change, institutions and capacity, as well as willingness to embed climate change risk assessment and management in development strategies. These conditions do not yet exist universally (O'Brien et al., 2006). Previous decades considered disasters as generally natural phenomenon and that it was part of nature's reaction to climate and weather situations. However, through the years, there is a growing realization that disasters are becoming closely correlated with human activities. In fact, studies have shown that some of the most harmful disasters are caused by human activities (Blaikie et al., 1994; Cardona, 2004; Cowles, 2015; Grothamm & Reuswigg, 2006. Some literatures (Chiang, 2018; Duzi et al., 2014; Fatti & Patek, 2013; Forino et al., 2017; Higginbotham et al., 2014) on disaster and climate change have shown that disasters have been a consequence of inevitable events that are done by nature or by actions of humans. In the current situation where the main characters of disaster are massive population growth, intense urbanization and uneven development, disaster assessment and management become an integral part of the planning and development concerns. There

is a close correlation between increased demographic pressure, especially in developing countries (most notably in less developed countries), growing environmental degradation, increased human vulnerability and the intensity of the impact of disasters. Detrimental development and inappropriate use of resources are contributory factors to natural disasters. They can accelerate or amplify recurrent phenomena such as droughts. Environmental degradation increases the intensity of natural hazards and is often the factor that transforms the hazard or a climatic condition such as heavy downpour into a disaster --- thus, river and lake floods are aggravated by deforestation which in turn causes erosion and clogs rivers (UNISDR, 2003).

Moreover, risk communication is an “intentional information transfer” and researches in this area focused primarily on probability and magnitude of risk. Transmission of risk messages are key components of risk reduction and its reception is affected by the construction of risk perception. At the individual level, two factors that affect the perception towards risk are trust and accountability. However, it was observed that some problems in risk communication are attributed to the lack of input from the communities, thereby, disregarding a participatory approach. Hence, initiatives on risk communication encourages a people-centered approach (United Nations, 2015).

Since risk communication is an interactive process of exchanging information and opinions between stakeholders regarding the nature and associated risks of a hazard on the individual or community and the appropriate responses to minimize the risks, O'Neill (2004) argued that the key to behavioral change lies in risk communication must be viewed in the context of the community's safety under the four stages of the disaster cycle. He also stressed that each of these stages require different type of messages since different people has varied and changing perception of risks. Moreover, a shift from response-oriented to a participatory approach translates into integrating the elements involved with the following strategies: locally focused and integrated planning; greater community participation and community-centric approaches. In addition, this also requires a shift of the community attitude towards risk reduction from merely receivers of the risk communication messages to integral part of the message conceptualization and development.

In addition, as risk communication is a core function that uses risk perception knowledge from the risk manager's perspective, the purpose of risk communication is to help residents of affected communities understand the processes of risk assessment and management, to form scientifically valid perceptions of the likely hazards and to participate in making decisions about how risk should be managed. Risk

communication tools, therefore, must explore all the possible tools that may be written, verbal or visual and utilizing the most appropriate media for such information, thus, there should be a synergy of various communication methods from traditional, modern and digital communication (Fatma SJORaida & Anwar, 2018). Thus, identifying the implications of risk perception and responses to flooding towards governance can contribute to the policy-makers' assessment of their approaches (Fatti & Patek, 2013).

Risk communication on disaster interventions

Communication between authorities and the public about disasters occurs in all stages of the cycle, with different aims at each stage. Thus, there is a need to assess and evaluate the effectiveness of the communication programs specifically on risk communication. Disaster studies emphasize the significant role of risk communication (Comfort et al., 2004; Mercado, 2016; Pidgeon et al., 2003; Kasperson et al., 1988; Terpstra et al., 2009; Lindell & Perry, 2012). Disaster risk reduction strategies can be enhanced through proper knowledge transfer of disaster communication from the different concerned agencies to the communities that would eventually implement the procedures presented therein. Consequently, focusing on how the communication tools and DRR strategies can be made more relevant to the target recipients.

Studies on risk communication highlights awareness and preparedness (Lindell & Perry, 2004) and the critical role of decision-making on disaster eventualities (Lindell & Perry, 2012). Specifically, flood risk communication studies have been documented highlighting the role of social networks (Haer et al., 2016), different strategies i.e. using agent-based model, tapping social networks and prevention-focused motivation to improve flood risk communication (Haer et al., 2016; Lazrus et al., 2016; De Boer et al., 2014) as well as looking at different perspectives to assess the flood risk communication systems towards upgrading awareness and preparedness (Maidl & Buchecker, 2015; Demeritt & Nobert, 2014; Rollason et al., 2018; Feldman et al., 2016).

On the other hand, Skinner and Rampersad (2014) mentioned that Nyondo in 2006 emphasized that if the process of communication is difficult in our ordinary and daily lives, it is far more so in times of disaster. 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. Communication is therefore a dynamic process with a two-fold purpose that 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, to cite Berlo's communication framework. In addition, Abarquez and Murshed (2004) 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 and Rampersad (2014) emphasized that 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. In addition, social vulnerability is key to determining the methods of communication and therefore people, complex social systems, and non-structural solutions should also be analyzed and considered.

Consequently, there are a number of local studies in Davao City 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 barangay 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) looked into the information, education, and communication (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) examined the disaster preparedness and awareness level of the community in Banay, Davao Oriental. Her results showed that at the barangay level, there is still a need to "localize" the approach on disaster campaigns, preparation and communication approaches. Meanwhile, Villanueva (2016) studied the reception of barangay 19-B of Davao City residents on the flood risk communication programs, strategies, and messages. His study revealed that improvements should be done to address the specific information-seeking concerns of the community. Similarly, Cayamanda and Lopez (2018) looked at the role of communication and social capital in building resiliency in the context of the 2011 flashflood incident of Matina, Davao City. Using the Crunch Model, the progression of vulnerability has

been determined as well as the institutional dynamics involved during the disaster. Results of the study revealed that despite the positive social relationships and immediate emergency response, there is a need to address the gap on disaster management that would encourage community-based processes and promote community engagement in disaster preparedness and management. These studies affirm the presence of communication efforts as DRR strategies, however, these also highlight the need for a community-based disaster communication systems and protocols.

CHAPTER 4

Risk Communication, Risk Perception, and Social Vulnerability

Risk communication is more than a research framework. It has become a concept that is strongly marketed by specific interest groups, and used instrumentally to achieve particular ends (Plough & Krimsky, 1987). Thus, it is 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 et al. (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 et al., 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 et al. (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 (Coomb's & Holladay, 2010). Although scholars have been working for decades to improve risk communication practice and refining communication theories and theories, these authors emphasized that there is no single theory or model can capture the full range of considerations that impact risk communication efforts. 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 et al., 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; Estacio, 2013; Garcia, 2010; Magalang, 2010; Sanchez, 2014; Sanchez & Sumaylo, 2015; Saño, 2010; Villanueva & Aid, 2010; 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 et al., 1999; Vin Hung et al., 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 et al., 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 et al., 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 and 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. Thus, social vulnerability frameworks and models have been developed.

CHAPTER 5

Theories and Models of Risk Communication and Disaster Studies

Risk Communication Studies

A critical prerequisite to effective disaster management is the minimization of related impacts through communication of risk information in a timely manner, and in a format that all stakeholders can understand. Attaining this mandate can be a major challenge for disaster managers, especially in an increasingly globalized world characterized by higher levels of multi-culturalism as increasing numbers of people migrate to locations outside their culture-zones where, not only language differs, but also perceptions of and attitude towards hazard/disaster risk (Martin, 2003). The challenge for disaster managers is therefore to design effective tools/strategies that not only span language differences, but also take into consideration cultural perceptions and attitudes so that the objectives of disaster risk-reduction can be achieved.

Risk communication studies in the context of disaster management may involve different theories and models to describe, predict and test a multitude of variables and interacting agents and it may apply to any of the three (3) risk phases: *preparedness*, *response* and *recovery*.

Sheppard et al. (2012) has presented a report to the US Department of Homeland Security which is a useful guide for emergency managers and communicators involved in risk communication and disaster management. It summarized and categorized relevant theories and models as follows: 'The first set labeled as "cross-cutting theories and models" are overarching approaches that demonstrate the complexity of the relationship between a message and its impact and how this message is affected by both the communicator and the intended audience. These are applicable to the preparedness, response and recovery phases of risks:

(1) the Crisis and Emergency Risk Communication (CERC) Model that focusses on identifying the most exigent publics; the Situational Theory of Publics (STP) aims to help institutions and organizations identify whom they should consider their publics and understand why these publics communicate and when they are most likely to do so;

(2) the Heuristic-Systematic Model allows the communicators to see and understand the connections between a person's desire for accurate and sufficient

information and the motivation for processing the information;

(3) the Deliberative Process Model consists of three steps to understand the areas of divergences and the potential for convergence among stakeholders and various publics: First, elicitation of values and criteria by stakeholders' groups; Second, provision for performance profiles for each policy option of experts and Third, the evaluation and design of policies by random sample of citizens.

Similarly, the authors also enumerated some of the theories and models that specifically applies to a particular event phase.

For the Preparedness Stage, five (5) theories/models were presented: the Actionable Risk Communication highlights the effectivity of the community members over public officials in sharing information of what actions to take to guard themselves from risks. Prompting risk reduction behaviors are effective when preparedness information comes from multiple sources, uses varied channels and frequently repeated. The Mental models, on the other hand, help assess publics' understanding of risks to capture the gap between their risk assessment vis-à-vis those of the experts and find areas of convergence and divergence. Affect heuristics explains how people make risk decisions based on what they have previously experienced and how they analyze situations, while,

Theory of Reasoned Action and Planned Behavior stresses that people determine if they will do something oftentimes based on their own views and of the society. The Risk Information Seeking and Processing (RISP) model emphasizes information sufficiency to identify differences between the individual's perceived current knowledge and the knowledge needed to appropriately mitigate risk. This model combines Theory of Planned behavior with Heuristic-Systematic model. If specific for the Response Stage, two (2) theories were identified that caters to the organizational response to events: the Image Restoration and Repair highlights focus on efforts to address organizational image, while, the Situational Crisis Communication Theory (SCCT) focusses on crisis management of the organization. Finally, the authors had three (3) models for the Recovery Stage : the CAUSE model aims to address and bolster public confidence after a disaster/risk event; the Precaution Adoption Model to address the audience's information needs to help elicit desired behavioral responses by publics; the Social Amplification of Risk Framework (SARF) that highlights the social context that encompasses factors that may amplify or attenuate the risk involving four stages : risk event, amplification, ripple effects and impacts. Finally, the Systems Dynamic model examines how communication can increase or reduce the secondary effects of an event (Sheppard et al., 2012).

Similarly, Lindell and Perry (2004) synthesized the literature on the theoretical frameworks on risk communication towards disaster studies captures the different areas covered by a disaster cycle in the context of risk communication studies encompass social influence (emphasis on source-message-channel-receiver-effect elements), behavioral choice focuses on cognition and perception studies), protective action (theories that link cognition with behavior processes) and innovation processes (attribution of behavior on innovative products and services) which shows that there is a wide variety of theoretical perspectives that can provide useful accounts of ways on which risk communication influences disaster response and hazard adjustments.

Moreover, some literature on studies of risk communication and disaster risk reduction management deal with the emerging field of complex adaptive systems (Comfort et al., 1999; Comfort & Kapucu, 2006; Comfort et al., 2004; Comfort, 2007) which Comfort and Kapucu (2006) refers to as the role of inter-organizational systems in public administration and organizational theory. In addition, Comfort and Kapucu (2006) synthesized the literature on this concept which is a broadly interdisciplinary literature as supported by the findings from the studies of Prigogine and Stengers (1984), Kauffman (1993), Holland (1995), Axelrod and Cohen (1999) which emphasized that reliable performance of information

functions under stress is a critical factor in achieving coordination among a large and varied group of actors engaged in crisis and disaster response. This performance depends on three major areas: the technical structure; organizational policies and procedures and willingness to adapt to the context of the situation (Comfort et al., 1999).

On the other hand, some models were also employed specifically to address the complexities of disaster management and factors that affect its success or effectivity. For this particular area of studies, some of the relevant disaster risk studies models are highlighted in the next section.

Disaster Risk Studies Models

Disaster risk studies have been instrumental in eliciting possible risk reduction strategies that involve communication. Khan et al. (2008) discussed that Disaster Risk Management (DRM) includes the sum total of all activities, programs and measures which can be taken up before, during and after a disaster with the purpose to avoid a disaster, reduce its impact or recover from its losses. The three key stages of activities that are taken up within disaster risk management (refer to Figure 1) are as follows: Pre-disaster phase is before a disaster and the activities in this stage are taken to reduce human and property losses caused by a potential hazard. For example, carrying out awareness campaigns, strengthening the existing weak

structures, preparation of the disaster management plans at household and community level, etc. Such risk reduction measures taken under this stage are termed as mitigation and preparedness activities. Disaster occurrence is during a disaster which include initiatives taken to ensure that the needs and provisions of victims are met, and suffering is minimized. Activities taken under this stage are called emergency response activities. Post disaster is after a disaster wherein initiatives taken are in response to a disaster with a purpose to achieve early recovery and rehabilitation of affected communities, immediately after a disaster strikes. These are called as response and recovery activities.

On the other hand, the Disaster Risk Management Cycle (DRMC) diagram (refer to Figure 2) highlights the range of initiatives that normally occur during both the Emergency response and Recovery stages of a disaster. Some of these cuts across both stages such things as coordination and the provision of ongoing assistance; while other activities are unique to each stage e.g. Early Warning for preparedness; Evacuation during Emergency Response; and Reconstruction and Economic and Social Recovery as part of Recovery. The DRMC also highlights the role of the media, where there is a strong relationship between this and funding opportunities. This diagram works best for relatively sudden-onset disasters, such as floods, earthquakes, bushfires, tsunamis, cyclones but

is less reflective of slow-onset disasters, such as drought, where there is no obviously recognizable single event that triggers the movement into the Emergency Response stage. In all the stages of the cycle, communication plays a vital role at different levels and with specific objectives.

The above-mentioned theories and models highlight the significant contribution of communication in disaster management and a valuable strategy for risk reduction. However, effective communication alone cannot address the need for building community resilience. Another critical factor is the identification and recognition of the social vulnerability of the community so as to contextualize the messages to be crafted for specific situations and audiences.

Social vulnerability models

The concept of *social vulnerability* recognizes the role that human systems and people's behavior and decision-making play in vulnerable conditions. It refers to all factors or properties of the human system including resilience, coping strategies and recovery from a disaster (Alexander, 2012). Wisner et al. (2012) proposed the Crunch Model of Disaster (see Figure 3) which classifies social vulnerability as root causes; dynamic pressures; fragile livelihoods and unsafe conditions. Social vulnerability is influenced by risk communication and gaps in risk communication translates into gaps in risk perception and

deficiencies in disaster preparedness and adaptation strategies (Stewart & Rashid, 2011). Elwood (2009) and Muffet-Willett and Kruse (2009) both viewed that systems or processes aims to simplify specific problem by isolating the major influencing factors (although at the expense of other factors). By so doing, they aim to enable their users to predict how systems or processes will behave as those pre-selected criteria alter. They are limited as they do not fully represent reality, and their effectiveness degrades as social phenomena are included. However, these are helpful in facilitating understanding, and highlights the following areas as well:

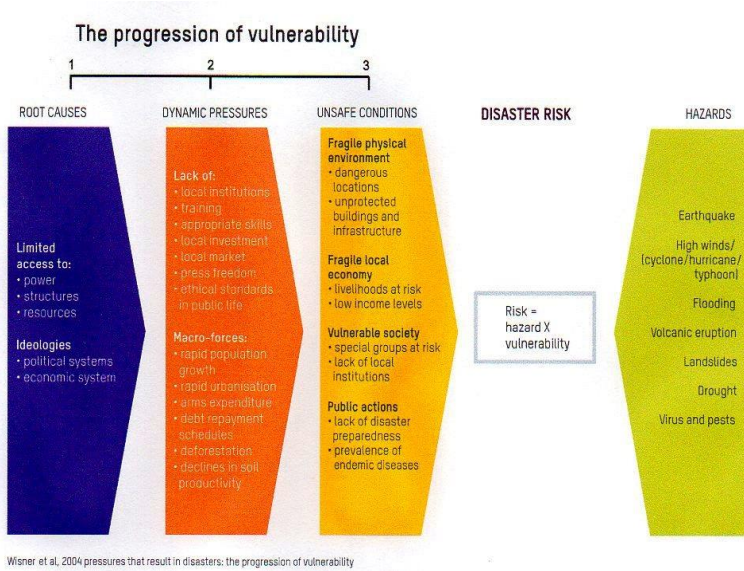
- “unsafe conditions” may be: poor housing conditions, dangerous location, risky livelihoods, lack of disaster preparedness skills, etc.

- “dynamic pressures” may be: no community organization for collective efforts to reduce flood risks, rapid migration tendencies that change the social structure, the lack of local markets for small farmers to sell their produces or buy agricultural inputs, etc.

- “root causes” may be: government negligence of sand mining in that river, the lack of government policy on flood warning systems and land use planning, poor men and women are not allowed to attend meetings on flood mitigation and emergency response preparedness.

Figure 3

The Crunch Model



Similarly, various studies on modelling risk communication have emphasized the role of transforming concepts into frameworks that are easier to operationalize (O’Neill, 2004; Reynolds & Seeger, 2005; Demeritt & Nobert, 2014) as well as developing information simulation model addressing mixed cultural societies (Clerveaux et al., 2009) and highlighted the dynamics of communication. Other models emphasized the role of protection motivation (De Boer et al., 2014), protective action decision model (Lindell & Perry, 2012) as well as social vulnerability models (Berkes & Ross, 2013;

Alexander, 2012) to emphasize the role of culture and social-ecological concerns to disaster risk reduction and management. A couple of studies have been documented in relation to the Davao City flashflood incident of 2011. Estacio (2013) made a study documenting the methods used by the local barangay unit in the post crisis phase of the disaster. 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 barangay 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 in 2014 looked into 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.

Systems Theory Approach

The literature on disaster and risk reduction studies revealed that a Systems Theory approach has been found to be useful in studying the elements of disaster management. This is guided by the Structural Functionalism paradigm which seeks to discover the functions of the different elements of a social

system to perform as one whole system. Since this approach sees society as a social institution and that as a complex system, it has social structures and social functions. Social structures referring to the social interactions and behaviors, while social function refers to the mechanisms involved in the existence of such social structure (Green, 2009). Systems Theory can be applied to governance and organizational analysis, sustainability analysis focusing on the interdependence of elements of social systems for long-term survival and accounts for the emergence of adaptation to the environment (Kemp et al., 2005).

Incidentally, systems theory is a transdisciplinary study of the abstract organization of phenomena, independent of their substance, type or spatial or temporal scale of existence and is also fundamental to organizational analysis and the dynamics of interrelationships. Communication as an integrated process is also guided by the systems theory in analyzing the dynamic process and the interdependent relationships of its elements as a multidisciplinary study from a holistic approach (Littlejohn, 2001; Infante et al., 1997).

Modern examples of *structural functionalist-oriented* research were observed in the study of the post September 11, 2001 attack. As the American culture was disoriented due to the attack, a shift in American travel customs was observed. There was a change in policy, thus, stricter scrutiny of travelers was

implemented which included new protocols like removal of shoes, belts and rejection of liquids on board. Thus, changing the practices in travel protocols. Moreover, studies on modern technology that changes the landscape of communication, i.e. video conferencing in business meetings replaced the face to face meetings, thereby losing social interaction's role in the structure.

The Social Amplification of Risk Framework (SARF)

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 et al. (2006) regarded this framework as an integrative framework that captures risk perception (Duckett & Busby, 2013) and social systems (Oinas-Kukkonen et al., 2010) which examine public risk perception.

Figure 4

Social Amplification of Risk Framework of Kasperson, et al., 1988)

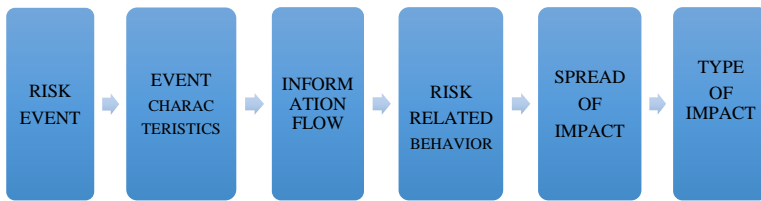


Figure 4 shows the amplification process starting with the risk event, that is, flooding in urban area. Its characteristics captured in communication messages and relayed to the target audience through the agencies and persons involved specifically those in authority. The communication signals will then 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.

Communication theorists introduced Kasperson et al.'s Social Amplification of Risk Framework (1988) 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, 2006; Machlis & Rosa, 1990). This framework, therefore, links the technical to psychological, sociological and cultural perspectives to highlight the “gaps” (Kasperson, 1986). Moreover, Relator (2016) emphasized that amplification of risk event is anchored by the communication process, transmission of signals from sources to the transmitters down to the receivers. Message is formed through a cluster of signals that are decoded by the receiver to understand the complete thought of the message. The transmitters intensify or attenuate the signals through altering, adding or deleting some of it.

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. These studies have shown the influence of the social amplification of risk in the field of risk communication research. Risk researchers have developed it as integrative and coherent framework for the empirical inquiry of risk and risk communication recognizing the role of the “amplification stations” and its “ripple effects” in terms of its impact and reach as well as the understanding of risk perception towards risk-related behaviors (Kasperson, 1986; Kasperson, 2001; Pidgeon et al., 2003; Renn, 1991; Renn, 2011; Renn et al., 1992; Relator, 2016). Other studies utilized SARF by operationalizing the social amplification using a systems approach in some communication tools like Twitter for risk events to capture the perceptions of professionals in health organizations regarding the use of Twitter during risk events (Comrie et al., 2019); public health amplification of disease-related information; social responses as an outcome of social amplification (Renn et al., 1992) and public experience of risk amplified by the stations (Machlis & Rosa, 1990).

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).

In addition, SARF's concept of the framework recognizes the significant role of interactions, linkages and boundaries as it also includes the assessment of multiple actors, the information and inter-organizational processes which calls for a system analysis approach. Kasperson (2001) stated that responses to "threats" depend on the social amplification of environmental risk, which sends signal to the society about the seriousness of risk and the extent of its damage. Various management strategies, therefore, are involved for preventive and precautionary intervention which requires the interplay of the political culture, public values, and role of industry and nature of regulatory system which calls for adaptive management strategies. This was reinforced by the findings of his earlier study in 1986 which recognizes the role of the differences in risk perception, credibility and trust, timing of program, technical and analytical resources, roles of public

involvement and some limitations that may affect public participation. Moreover, Renn (2011) utilized SARF and concluded that human beings perceive risk being a threat to their well-being and the magnitude of its impact is co-determined by values, attitudes, social influences and cultural identities as such behavior to risk is greatly affected by the intensity of the societal concern and action as reflected by the role of the institutions, the flow and reach of its communication.

Researches in risk reduction management have been known to use varied methods which are greatly dependent on the objective of the risk communication study: case study, network analysis, experimentation, models and framework development towards disaster management. Mixed methods approach is also used combining the qualitative with quantitative analyses of data.

CHAPTER 6

The Case of the Flood- vulnerable Communities

The previous discussion shows that although there exists a substantial literature on disaster and its related concepts, no related study or literature has been found specifically on risk communication management. Hence, this study would integrate risk communication and disaster management focusing on a localized urban flooding incident and how it can contribute to the development of a community-based flood risk communication framework utilizing the data collected from the flood-prone communities.

Risk communication management in the context of this study include elements such as policies or legal basis of the agencies task/function, the communication protocols or procedures, and flow of communication and messages; the inter-governmental management reflecting the dynamic interconnections between and among the agencies involved as well as their specific role in the communication process and

organizational linkages; and the communication processes on the efforts and strategies used for risk communication. Risk communication management at the community level would ensure that specific needs, expectations and levels of access to disaster related information are integrated into the risk communication approaches. Thus, empowering the communities to build resilience and capacities to respond appropriately to flooding incidences.

This study attempts to describe and explain the functions of the over-all system involved in disaster management by focusing on the relationships between various social institutions. Specifically, it covers the analysis of the role of institutions, the community, as well as the policies and governance that are involved in the performance of disaster risk reduction management. The multi-disciplinary framework of development communication is highlighted in this study.

Davao City as an Urban area vulnerable to flooding

Flooding is a common occurrence in different parts of the Davao City and its effects are catastrophic in proportion costing damage to properties and disruption of development initiatives and economic activities, and even loss of lives in some cases (Cayamanda & Lopez, 2018). The National Disaster Risk Reduction and Management Council's (NDRRMC) assessment and identification of the flood risk

areas are based on the hazard maps developed by different agencies such as the United Nations, and the Meteorological and Geosciences Bureau (MGB). The hazard map shows the vulnerable areas for natural hazards in the country and Davao City has been identified as susceptible to flooding. In addition, a study on the Business Risk Assessment and Management of Climate Change Impacts of 16 cities from 2011 to 2013 conducted by the World-Wide Fund (WWF) shows that even though Davao City is located in a typhoon-free zone, it is susceptible to dangerous floods in areas adjacent to the city's rivers. There are several rivers that run through the city and drain into the Davao Gulf. The largest of these waterways are the Davao and Talomo Rivers where thousands of residents are most likely to be affected in case of flooding (Business World Online, 2015; Estacio, 2013; Sanchez & Sumaylo, 2015). Davao City is experiencing unprecedented development in recent years, and more so with the Duterte 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, etc. As a consequent of this urbanization, flooding has been the most occurring natural event and the frequency of typhoons and storms that pass through the Philippines makes it more vulnerable to flooding (World Bank, 2012; Magalang, 2010; Estacio, 2013; Sanchez & Sumaylo, 2015). Davao City has 182 barangays and 68 are considered vulnerable to flooding. The Davao City Office of Planning and Development (DCOPD) and Disaster Risk Reduction and Management Office (DRRMO) records reveal that flooding and landslides are repeated occurrence in Davao City (2011). However, the flashflood of 2011 has created an impact that shows the need for a policy challenge on the disaster preparedness and response at the community level. Since flooding are common occurrence in different parts of Davao City, damage to properties and loss of lives are catastrophic in proportion particularly among the vulnerable groups and communities (Cayamanda & Lopez, 2018). Thus, focused flood risk communication messages should be studied and recommended (Villanueva, 2016). Communities need to build its resiliency to respond to flooding occurrences while policy makers and leaders need to regularly review and upgrade its existing policies to address gaps and promote effective community-based strategies.

In addition, some related studies on flooding as a disaster occurrence in the Philippines has revealed that not all incidents are due to natural causes. Magalang (2010) stressed that as the Philippines is part of the typhoon belt, the climate change phenomenon and rapid urbanization makes the country vulnerable to flooding. Therefore, there is a need to enhance the community-based approaches on flood preparedness through vulnerability identification, strengthening community resilience and examine the significant role of the communities to reduce their vulnerabilities.

THE CASE STUDY in DAVAO CITY

Communities need to build its resiliency to respond to flooding and mitigate its negative impacts since the country cannot avoid typhoons and its associated hazards and/or risks. Minimizing the cost and damage through preparation and coordination is a strategy, while policy makers and leaders need to consciously regularly review and update its existing policies to address gaps and promote effective risk communication as an integral element of risk reduction. Moreover, to encourage community-based approach through organized collaboration of individuals, communities and organizations, thus, this study focusses on risk communication management.

The purpose of this study was to examine the role of risk communication management in the reduction of risk among the flood vulnerable communities. It aimed to answer the following questions:

(1) What was the existing risk communication system in response to flooding of Davao City?

(2) What were the experiences and practices of the flood vulnerable communities in using risk communication protocols, strategies, tools, and messages to reduce their vulnerability to flooding?

(3) Are the flood vulnerable communities aware of the risk communication system of Davao city?

(4) How did flood vulnerable communities perceive and respond to the risk communication system of the disaster management council?

(5) What factors affected the perception of the respondents to the risk communication management of the local government units?

(6) What risk communication management would be appropriate for flood vulnerable communities?

Objectives of the Study

The main purpose of this mixed-method research was to analyze the role of the risk communication management in the

disaster risk reduction among the flood vulnerable communities. Specifically, it aimed to:

(1) Describe the current risk communication system of the local government units in terms of the actors and their roles in its implementation;

(2) Examine the respondents' experiences and practices in using risk communication protocols, strategies, tools, and messages to reduce their vulnerability from flooding;

(3) Assess the awareness and perception of the respondents on the risk communication system of the local government's disaster risk reduction council;

(4) Analyze the relationship between the respondents' socio-demographic factors and their risk related behavior; and,

(5) Develop a community-based flood-risk communication management framework for the flood vulnerable communities.

Scope and Limitation of the Study

Most of the literature on disaster studies emphasize the “top-down” approach which is also the existing management framework being used in the Philippines, following the NDRRMC plans and manuals. This study employed a mixed-methods approach aimed to come up with a risk communication management framework emphasizing a localized and participatory approach to address the needs and

context of the flood vulnerable communities of Davao City. The qualitative phase of the study primarily focused on the communication flow from the city government agencies towards the flood vulnerable communities to explain the transactional process involved in the dissemination of the risk messages cascaded from the national level. The analyses of the review of literature and the data from the key informant interviews (KII) served as inputs in the construction of the survey questionnaires. The responses to the focus group discussions (FGDs) were used to reinforce the findings of the study and provide specific examples but not disregarding the fact that other factors may have affected their participation and responses to the questions on their assessment of the risk reduction efforts. For the quantitative phase, the survey method conducted from November 2017 to April 2018 was used to describe and explain the awareness and assessment of the flood vulnerable communities on the risk communication system.

The analysis of the risk communication system is limited to the level of communication flow and would not provide conclusive analysis on the rationale and agenda setting components of message formulation from the major source which is the NDRRMC or the national level, rather, provide a descriptive analysis which would show the current risk

communication system and its transactional process being implemented.

Significance of the Study

The significance of this study is on risk communication management as another strategy to disaster risk management, with emphasis on a community-based approach that encourages local participation. This presents a novelty of approach as well as a valuable contribution to the literature on disaster studies in the context of development studies.

Further, the 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. The results would also enhance the risk communication management of the local government units in addressing the needs and context of the flood vulnerable communities.

The inputs of this research may provide policy-relevant information useful for the CDDRM Council and member agencies, the barangay leaders, and the Sangguniang Bayan with regards to plans and strategies in reducing the flood risk towards community resilience.

Moreover, a recommendation for a risk communication management framework on flooding may be utilized by the Davao City council for possible policy recommendation that will highlight a community-based framework on risk communication management.

Methodology

Research Design

This study used a mixed method design, the Convergent Parallel Design. This approach utilized both the quantitative and qualitative data collection techniques, analyze separately and then merge for comparative or integrative discussion and interpretation (Creswell & Clark, 2011; Creswell & Creswell, 2018; Terrell, 2012).

The study is descriptive and formative in its approach, and applied both qualitative methods such as document reviews, content analysis, system analysis, Key Informant Interviews (KIIs) and Focus Group Discussions (FGDs) and further reinforced using a quantitative method which is a survey. The research matrix is summarized in Table 1.

Table 1*Matrix of objectives by source and type of data*

Objectives	Sources Of Data	Type Of Data
1. Describe the current risk communication system on flooding of the local government units in terms of the actors and their roles in its implementation.	Key Informant Interviews (KIIs) Document reviews FGDs among agencies involved	Qualitative Policy Analysis Thematic and content analysis
2. Examine the respondents' experiences and practices in using risk communication protocols, strategies, tools and messages to reduce their vulnerability from flooding.	Survey FGDs among residents of flood-vulnerable communities	Quantitative Qualitative
3. Assess the awareness and perception of the respondents on the risk communication system of the local government's disaster risk reduction council.	Survey FGDs among residents of the flood vulnerable communities	Quantitative Qualitative
4. Analyze the relationship between the respondents' socio-demographic factors and risk related behavior	Survey FGDs among residents of the flood vulnerable communities	Quantitative Qualitative
5. Develop a community-based flood risk communication management (CBFRCM) framework for flood vulnerable communities	Inputs from objectives 1 to 4	Quantitative Qualitative

Conceptual Framework

The study investigated the flooding of Davao City guided by the social amplification of risk framework of Kaspersen et al. (1988). Risk events were described utilizing the primary and secondary data reflecting the experiences and vulnerabilities of the communities to flooding. The information flow was investigated in terms of the current risk communication system

and its implementation utilizing the policies as well as the local government units as the agencies involved in terms of the actors and their roles in the implementation. Augmentation of the study of information flow included the examination of the strategies, communication tools and the messages used. In analyzing the communication systems involved in risk reduction this study would draw its analysis from the emerging field of complex adaptive systems (Comfort, 1999; Comfort, 2007; Comfort & Kapucu, 2006; Comfort et al., 2004; Comfort et al., 2004) with the underlying assumption that disaster management involving the areas of preparedness, mitigation and prevention would involve the interdependent collaboration of the different sectors involved: government agencies, private institutions, volunteer groups and the vulnerable communities as well. A study applying CAS in studying the dynamics of organizational structure and flow of communication amidst complexities and changes revealed that interdependence among elements involved would help plan and develop a more facilitative and systematic approach to communication processes (Dickens, 2012). In addition, the Communication Network Model (Lindell & Perry, 2004) was used to complement the objective to describe and discuss the communication systems. This approach is based on the communication models (Petersons & Khalimzoda, 2016) of Laswell in 1948 which takes into account the significant role of

the Sender-Message-Channel-Receiver-Effect (SMCRE) and its interdependent relationships that account for an effective communication process as well as Berlo's concept of duality in 1960 of the roles of the sender and receiver, taking into account the environmental, physical and social factors that affect message formation, perception and reception (Littlejohn, 2001; Littlejohn & Foss, 2008).

The analysis of the vulnerability characteristics was 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 as well as their flooding experiences in terms of frequency of flooding, depth of water level in feet, perceived causes of flooding as well as the effects.

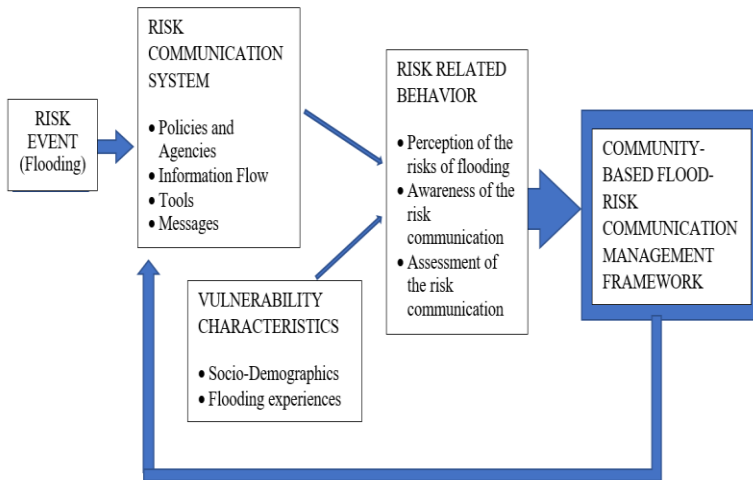
In terms of the *risk related behavior*, the study investigated the flood vulnerable communities' responses to flooding and their perception of risks. The *spread of impact* was investigated utilizing the respondents' awareness, perception and assessment of the current risk communication system.

The *type of impact* is reflected by utilizing the findings from the quantitative and qualitative findings and integrating these results to help develop a community-based flood risk communication management framework for the flood vulnerable communities in addressing a more inclusive risk reduction strategy. It can also provide useful information towards policy recommendations and possible appropriate

governance adjustment in the management of risk communication as well as provide suggestions for appropriate capacity building towards a localized and participatory approach on risk reduction.

Figure 5

The Conceptual Framework of the Study



The conceptual framework used for this study is an integrated model of the social amplification elements in the context of disaster risk management which highlights the following: (1) the analysis looks at the interactions, linkages and boundaries of the communication systems that recognize the roles of the policies involved as well as the multiple actors (agencies and communities); the information flow (strategies, mechanisms and inter-organizational processes); (2) SARF as a comprehensive theory of public experience of risk; and, (3)

integration of risk perception, experiences and feedback of the community will provide policy implication towards a more inclusive and community-based flood-risk communication management towards a localized risk reduction management plan.

Operational Definition of Terms

Flooding - is the specific risk event under investigation in this study, which refers to the rise of water level in the flood vulnerable communities. Flood vulnerable communities have been identified by the disaster risk reduction and management office and have been under close monitoring when there is a rainfall. It often results to inconvenience or possible harm to the communities.

Risk Communication system - the guidelines and flowcharts of the flow of communication being followed, the protocols and the appropriate inter-organizational coordination by the agencies involved in the disaster risk reduction management of Davao City. It is composed of the following elements:

Policies - the legal basis for the implementation of the program which include Republic Act, Local Government Code, City or barangay ordinances;

Agencies - the local government units involved in disaster-related concerns as specified by the RA 10121 in the

NDRRMP and the related policies at the municipal and barangay levels;

Information flow - the structure of the dissemination of messages; it can either be formal or informal; top-down or bottom-up; vertical or horizontal;

Tools - refers to the materials and resources used in the risk communication, categorized as mass, social or electronic media; written; visual; audio or interpersonal;

Messages - information that risk communication is trying to convey to the target audience, for instance, information on location of evacuation centers;

Vulnerability characteristics - refers to how the residents feel threatened about the degree of impact of flooding occurrences to their lives, livelihood and their assumption of the possible causes of flooding and their exposure to flooding;

Socio-demographic characteristics - refers to the combination of social and demographic factors that describe a group or individual i.e., age, gender, monthly gross income, level of education;

Age - categorized according to the NEDA age classification index as young (ages 21 and below); middle age (ages 22-45); senior citizen (above 60 years of age);

Highest level of education attained - the level of education that the respondents has achieved at the time the

survey was conducted. The categories include: no education, elementary, high school, college and vocational;

Monthly gross income - the earnings of the household bracketed using the BIR system for 2017 categorized as 10,000 and below; above 10,000-30,000; above 30,000-70,000 and above 70,000-140,000;

Years in residence - the actual number of years of stay in the community during the time the survey was conducted. It was categorized as: 0-10 years; above 10 -20 years; above 20 - 30 years; above 30 - 40 years; above 40 - 50 years and above 50 - 60 years;

Religious affiliation - categorized into three only: Roman Catholic, Islam, and Others which include Protestants, Baptists and Christians, among others;

Flooding experiences - the frequency and occurrences of flooding as well as depth and effects to the households and community. Frequency has been categorized into always, frequently, occasionally, rarely or no experience. Depth of flooding has been estimated using feet; while perceived causes associated with flooding was categorized into: when it rains, during rainy season, strong typhoons, among others. Similarly, respondents were asked to recall the effects of flooding to households and community in terms of damaged houses, damaged crops, drowned animals, disruption in work or school and dirty environment;

Risk related behavior - response and practices of the residents in preparation and during flooding occurrences in their area which include their responses to flooding categorized into the timeliness of preparation; reasons or motivators to prepare and reasons for evacuation;

Perception of risk - the idea or understanding of the flood vulnerable communities about the risks of flooding which they associate directly to causes of flooding and the impact of the overflowing of the river systems of Davao;

Awareness of risk communication - the respondents' knowledge or familiarity of the risk communication system being implemented by the Barangay Disaster Risk Reduction Management Office (BDRRMO) or City Disaster Risk Reduction Management Office (CDRRMO). Specifically, in terms of the risk reduction strategies categorized into: use of communication tools; trainings and seminars; drills; use of early warning devices like alarm, siren, house to house, use of megaphone and handheld radios and community assemblies. It also included identification of the most common sources of information on DRR strategies as barangay, city or national level. Moreover, the respondents' awareness of the communication tools as source of information on flooding;

Assessment of risk communication - the level of acceptance and evaluation of effectivity of the risk communication system. This was asked using statements

provided by the researcher and the risk communication efforts were rated using a Likert Scale with the following categories: - 1-Very Poor, 2-Poor, 3-Average/Fair, 4-Good and 5-Very Good;

Risk communication - the process of the risk reduction efforts involving the dissemination of information to the communities which involves strategies, tools and messages, both at the level of the national and local communities (barangay);

Community-based - the “localized” and participatory approach whereby communities are empowered to conceptualize, develop and utilize their own strategies and knowledge on flooding occurrences;

Flood-risk communication management - plans and strategies related to the communication of flooding and its associated risks.

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 (see Figure 6). 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). The Davao City River

is one of the seven catchments or river basins, 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. Davao City is experiencing unprecedented development in recent years, and more so with the Duterte 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. Magalang in 2010 cited that the International Bank of Reconstruction and Development (IBRD) 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". The frequency of typhoons and storms that pass through the Philippines makes it more vulnerable to flooding (Magalang, 2010).

Moreover, the United Nations Development Program (UNDP, 2013) has emphasized that Mindanao in the southern part of the Philippines is not traditionally prone to typhoons,

however, the onslaught of typhoon Washi in 2011 and typhoon Bopha in 2012, caused widespread damages and thousands of casualties as well as injuries. While climate projections for the years 2020 and 2050 indicate a generally drying trend in Mindanao, a closer look at regions 10 and 11 reveal a positive increase in precipitation during the period of December to January. These experiences have proven that there is a growing trend of disaster vulnerabilities which requires prioritization for climate change adaptation and disaster risk management.

Figure 6

Locator map of Davao City, Philippines (DC-OCPD Manual)



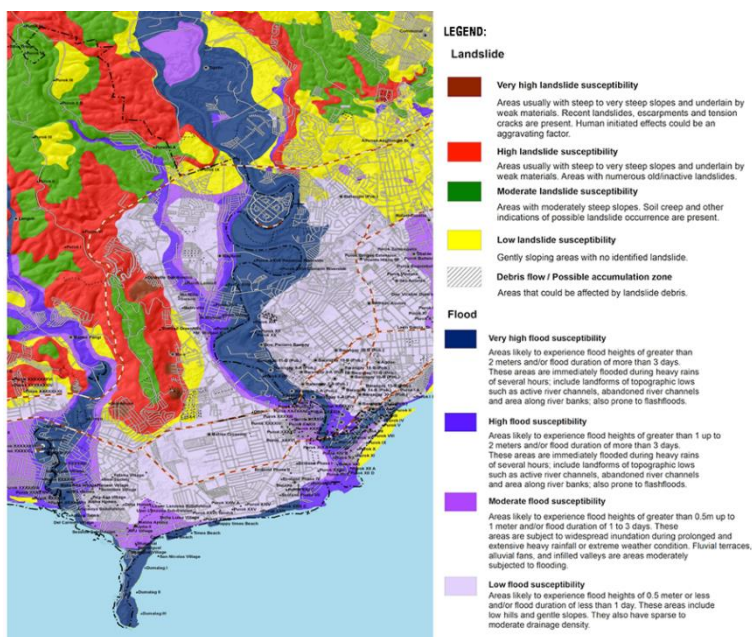
Having an area of 244,000 hectares, Davao City is among the largest city in the world in terms of area. It may be located in typhoon-free zone, but it is susceptible to dangerous floods in areas adjacent to the city's rivers. Largest waterways drain into the Davao Gulf, particularly Davao and Talomo Rivers are the most important river basins in the city and pass through heavily populated areas in the city. Consequently, thousands of residents are most likely to be affected in case of flooding (DC-OCPD Report, 2016; Business World Online, 2015; Magalang, 2010; WB, 2015). 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 (DCDRRMO report, 2011).

In addition, the disaster vulnerability of some areas in Davao City reflects that majority of the barangays are vulnerable to flooding incidents (Figure 7). 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). Records show that the repeated occurrence of floodings and landslides in Davao City from 2009-2013 caused a total of 77 cases of flooding and one flashflood that affected

a total of 8,656 families (DCOPD Report, 2016). The flashflood of 2011 in the areas of Matina, Davao City, that caused the biggest adverse impact to 3,604 number of families affected (DCDRRMO Report, 2011) showed the need for a policy challenge on the disaster preparedness and response at the community level.

Figure 7

Flooding and Landslide Vulnerability map of Davao City (DCDRRMO Manual)

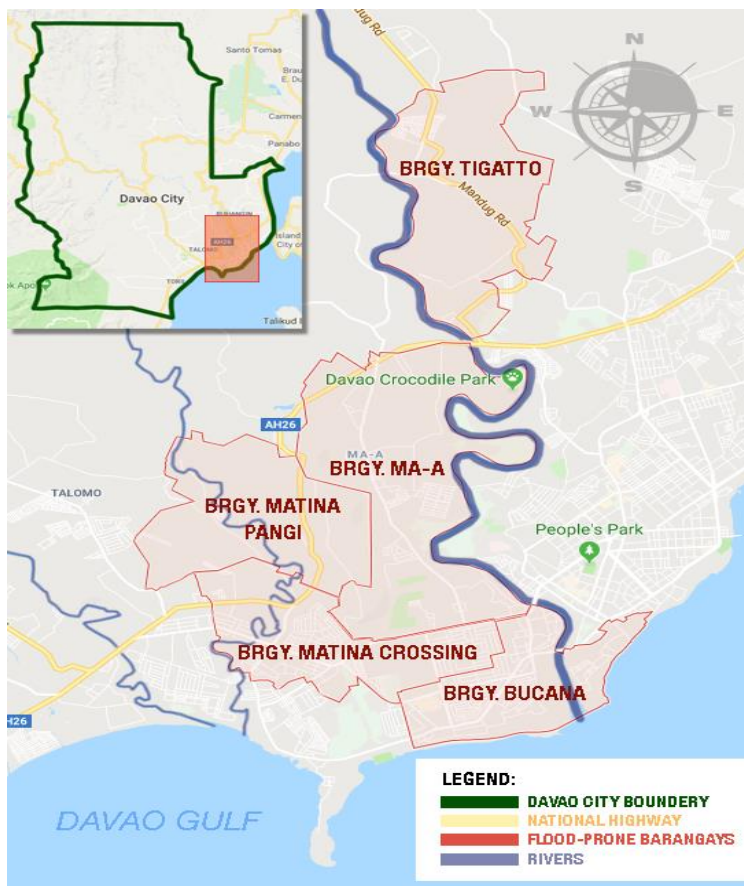


The locale of this study, therefore, was identified using a multi-level purposive sampling using the flood-vulnerability of the community as a major criterion. First, was the identification of the most vulnerable barangays to flooding based on the hazard map of the city and the affirmation by the Offices 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 (CDDRMO). 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. Further, the institutions like banks, schools, groceries and public markets are found in the area, which classified the areas as urban with a high-density residential zone and socialized housing zone (DCOPD Manual). 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 (CDDRMO Reports). Figure 8 shows the location map of the research locale.

Figure 8

Location map of the research locale (DC-DRRMO)



Sampling Design

A multi-stage sampling was employed in this study using the top 5 barangays identified by the DRRMC as the high-risk flood vulnerable areas in Davao City. Because of the possibility that in these flood vulnerable barangays, some puroks may not

be prone to flooding, the flood vulnerable puroks were also selected and a simple random sampling of households was done. The data from the CPDO as regards appropriate clustering of the flood vulnerable puroks were used as the basis for the determination of the total population. Based on the clustering, the puroks were determined to identify the sample population. From this data, a sampling frame was generated from the barangay offices as the basis for the simple random sampling to identify the specific households as the respondents of the survey. To give each household equal chance to be selected, random numbers were generated using the MS-Excel. Using the formula below, a sample size was determined with a 95% confidence level and .05 margin of error.

$$n = \frac{PQ}{d/2^2}$$

where:

P is the proportion of the target population that is based on prior information

Q is (1-P)

d= degree of error

Adjusting for the population of 6,177 in the flood prone puroks, the computed total sample was 376.

$$n = \frac{0.50 * 0.50}{(0.05)/2^2}$$

$$n = \frac{1111}{(1 + 1111/6177)} = 376$$

Using proportional allocation, the number of samples by respondents is shown in Table 2. Among the five barangays, Barangay 76-1 Bucana Proper has the highest number of respondents with 135 because it has the higher number of population at risk of flooding. Meanwhile, Matina Pangí with the lowest population at risk has the lowest number of samples with 45.

Table 2

Distribution of survey respondents by barangay and purok.

Flood-Prone Barangays	High-Risk Puroks	Household Population	Respondents
Tigatto	1. Jade Valley	642	39
	2. Sitio Lourdes	98	6
	3. Uyanguren	210	13
	4. San Isidro	75	5
	5. Sta. Marina	135	8
	Sub-total	1160	71

Flood-Prone Barangays	High-Risk Puroks	Household Population	Respondents
76-A Bucana Proper	1. DAPSA	297	17
	2. St. John	283	18
	3. Pasil	1086	66
	4. Agro Compound	252	15
	5. Kasilak	302	19
	Sub-total	2221	135
Matina Pangi	1. Purok 1-A	105	6
	2. Purok 1-B	84	5
	3. Purok 3-A	197	12
	4. Purok 4-A	126	8
	5. Purok 7-A	230	14
	Sub-total	742	45
Matina Crossing 74A	1. Arroyo Lower	282	17
	2. Balusong 1	81	5
	3. Golden Valley	260	16
	4. Gravahan 1	269	16
	5. Guadalupe 1	201	12
	Sub-total	1093	66
MA-A	1. Gravahan Purok3	34	2
	2. Gravahan Purok4	160	10
	3. Purok 20	460	28
	4. Riverside	26	2
	Sub-total	961	59
	TOTAL	6177	376

Data Collection Instruments

The qualitative method was specifically employed to describe the communication system on flooding of Davao City. The policy analysis was used to examine the provisions of Republic Act 10121 to identify the protocols that are expected from the implementers of the policy, findings of which were utilized to develop the guide questions used for the key informant interviews to find out how the national policy was adapted by

the city and transmitted to the barangay and purok levels. The data collected from the KIIs were processed through thematic and content analysis to find out areas of concern that should be considered in the development of the questionnaire as an instrument for the survey among the flood vulnerable communities. The findings and results from the quantitative approach, however, were reinforced with the qualitative approach using the focus group discussions (FGDs) conducted after the survey. A total of ten (10) FGDs were conducted in two (2) sets per barangay, comprised of barangay captain, purok leaders and BDRRMC personnel for the Set A representing the implementors, the schedule reflected on Annex Table 1. Meanwhile, the FGDs among the residents of the flood-vulnerable communities as Set B were conducted on different schedule as reflected on Annex Table 3. Focus Group Discussions were likewise conducted for clarification or verification on awareness and perception of the communication system from the implementors at the barangay level and the community as well.

On the other hand, the quantitative method utilized the data from the survey among the flood vulnerable communities to explain their experiences and practices in reducing their vulnerability to flooding. The survey questionnaire was divided into four sections. The first part included questions on the perceptions, awareness, experiences and responses to flooding

occurrences. Specifically, this part included questions to find out the respondents' perception and awareness of risk, knowledge and experiences on flooding, flood-risk acceptance and responses on flooding. Moreover, socio-demographic and economic characteristics were also included in this section.

To determine the respondents' knowledge on the communication protocols and efforts on disaster-related information, the second section includes items that describe the type of information, efforts and activities as well as the sources of information.

The next section of the instrument seeks to find out the awareness and examine the perception of the respondents on the communication tools and the respondents' assessment of the efforts on risk communication based on their attitudes, behavior and responses on the barangay efforts and messages as well as their assessment of these tools and efforts.

The findings of the survey were reinforced through the use of the focus group discussions. The FGDs provided in-depth information to the items included in the survey instrument. Moreover, it provided the participants the opportunity to discuss further some items related to assessment of vulnerabilities, perception and experiences through their narratives. It also provided further discussions on their assessment of the communication strategies as well as their reception of these messages and efforts.

Data Gathering Procedure

The research involved several data collection techniques including secondary data, survey, key informant interviews (KIIs), and focus group discussions (FGDs). The documents consisted of the National Disaster Risk and Reduction Management Plan (NDRRMP), Executive Orders of the Davao City government on the City Disaster Risk and Reduction Management Office (CDRRMO), and barangay local ordinances on disaster plans. These documents were instrumental in describing the existing systems of communication on disaster and risk concerns on flooding from the city government level to the flood vulnerable communities.

Key informant interviews were done in the months of August and September 2017. Representatives from the agencies responsible for the disaster-related incidents such as the: (1) Public Safety and Security Command Center (PSSCC); (2) City Disaster Risk and Reduction Management Office (CDRRMO); and (3) LIGA-Association of Barangay Captains (Liga-ABC) served as the key informants of the study. They were interviewed on the communication system currently being implemented by the city as regards to disasters, particularly, flooding.

Meanwhile, the survey questionnaire was crafted utilizing the literature review, previous studies and some themes from the KIIs. The questions covered in the survey questionnaire

included the socio-demographic and economic characteristics of the respondents and their households, respondents' perception on the risks of flooding, their experiences with flooding, and their awareness and assessment of the barangay efforts in the risk awareness, disaster preparedness, risk reduction and mitigation of flooding. The alpha coefficient for the questions on attitude and perceptions was .904 as indicative of acceptable reliability. George and Mallery (2003 as cited in Gliem and Gliem 2003) provide the following rules of thumb: “_ > .9 – *Excellent*, _ > .8 – *Good*, _ > .7 – *Acceptable*, _ > .6 – *Questionable*, _ > .5 – *Poor*, and _ < .5 – *Unacceptable*” (p. 231).

The draft questionnaire was initially pre-tested to 20 respondents from the Matina Aplaya area on a self-administered approach on September 22, 2017. However, after the pre-test, the researcher found it more appropriate to administer the survey through an enumerator who can converse in the dialect and can expound on some questions that requires elaboration from the respondents. Thus, an enumerator was sought to allow respondents to be clarified on their concerns about the questionnaire in the local dialect. The survey questionnaire was revised according to the results of the self-administered pre-test. The questionnaire was prepared in English but with a translation in the local dialect that the enumerator used during the survey proper. The survey was conducted from November 2017 to March 2018 among 376

respondents in the priority puroks of the top five barangays. It should be noted that 23 survey questionnaires were not retrieved from the respondents due to their inability to complete the entire questionnaires, hence the total number of respondents was reduced to 353. The computed response rate of 94% is higher than the unwritten standards of 86.8% among published journal articles (Carley-Baxter et al., 2008). According to Carley-Baxter et al. (2008) while journal editors overwhelmingly (approximately 90 percent) say that response rate is at least somewhat important in publication decision-making, it would appear that such a feeling or perception is loosely interpreted; that is, there are not written standards or conventions for either reporting response rate information or deciding minimum thresholds.

The focus group discussions were conducted in the five barangays composed of two sets of participants each: SET A categorized as the implementers was composed of the barangay captains, purok leaders and members of the barangay disaster risk and reduction management group; and, SET B categorized as barangay residents was composed of the selected residents from the flood-prone communities. This was done to give the researcher the opportunity to validate the responses and the information from the key informant interviews and further elaboration on the survey questionnaire's open-ended questions. The survey enumerator

also served as the facilitator/moderator of the FGDs to understand the queries from the participants and at the same time capture the elaboration even if the participants spoke Bisaya. Engaging the services of a person who knows the local dialect was found to be useful as participants were able to expound on their ideas in their native dialect with ease and comfortability. Thus, enabled us to solicit a more comprehensive discussion with them.

A transcriber cum documenter was engaged to cover the photo documentation of the process of the data collection. He was also requested to translate into English the transcriptions of the FGD recordings since the researcher is not a native speaker of the dialect.

Furthermore, for ethical considerations, both the survey and the FGDs were conducted with an Informed Consent Form, giving the respondents and participants the objectives of the study and how the data will be processed and utilized for the study.

Data Analysis

Qualitative data were analyzed using themes while quantitative data obtained from the survey of residents of the flood vulnerable communities were analyzed using the Microsoft Excel for descriptive analysis. On the other hand, 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. The analytical framework is presented in Figure 9, while the summary of data and methods of analysis is presented in Table 3.

Figure 9

Analytical framework of the study using the Convergent Parallel Design

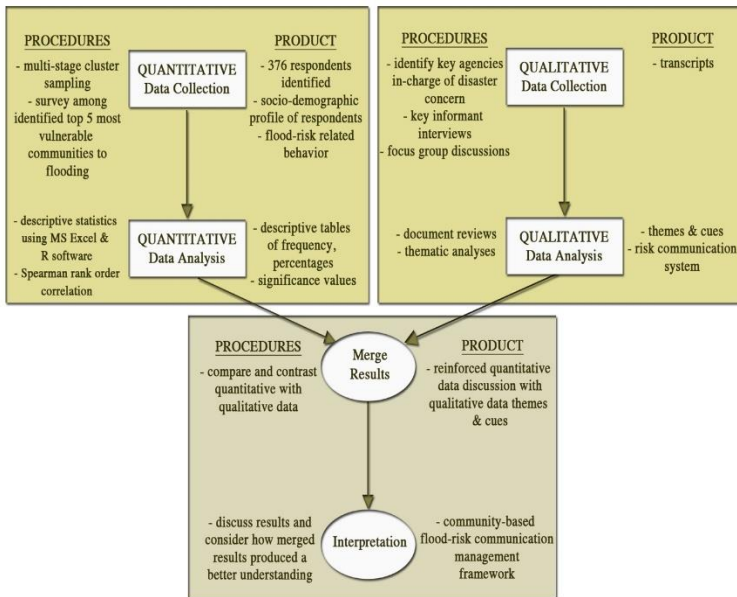


Table 3*Summary of data collected by method of analysis*

Data Collected	Method of Data Analysis
SET A - Implementers	
Messages and Strategies for risk communication	Analyses of Transcripts from KII
Existing Policies and Programs	Document review
Information and Communication Flow	Document review
SET B - Residents of flood vulnerable communities	
Socio-demographics	Frequency, percentage, graphing
Residential profile affecting flood vulnerability	Frequency, percentage
Residents' knowledge, attitudes and perception on flooding and risk communication	Frequency, percentage, graphing
Residents' experience and behavior on flooding	Frequency, percentage
Relationship between assessment and socio- demographics	Spearman Rho
Residents' awareness and attitude on barangay efforts and tools	Frequency, percentage
Residents' awareness and sources of information on flooding	Frequency, percentage
Other factors affecting message reception	Thematic Analysis
Integration of the qualitative and quantitative data	Development of the community-based risk communication framework

Results and Discussion

The Current Risk Communication System of Davao City

Risk communication plays a central role in risk management. Several studies have provided different forms, ways, and strategies for transmission of risk messages on the classic linear message transmissions of sender-message-channel-receiver-effect models of Berlo and Laswell (Petersons & Khalimzoda, 2016). Kasperson et al. (1988) viewed that perceptions of risk are influenced by a network of socially mediated communication channels that can be either formal, such as the media, public relations campaigns, and community meetings or informal such as word-of-mouth and interaction within social networks. The process of sending and receiving risk signals involve filtering and decoding, information processing, attaching social value to the information and as an impact, specific mental perceptions and behaviors are expected. This linear communication flow emphasizes the role of source credibility as a significant factor that affects message reception. Lundgren and McMakin (2013) however, defined risk communication as a two-way communication which involves the authorities communicating the risk and that of the audience receiving these messages. In reality, there is no one generic guideline of risk communication transmission because of the

dynamics and variations of context among audiences, backgrounds, and environments.

Comfort et al. (1999) emphasized that as risk communication on disaster research has shifted its advocacy towards vulnerability identification, risk perception and community resilience lead to a growing literature on risk communication studies using the complex adaptive systems as the more relevant and integrative communication systems in disaster risk and mitigation. Further, she added that it involves three major components: 1) institutions which provide the technical structure needed to support communication and management; 2) intergovernmental management which refers to the organizational policies and procedures as well as the protocols involved therein and 3) auto-adaptation which provides collective learnings toward openness and willingness to adapt to the context of the disaster situation (Comfort, 2007; Comfort et al., 2004; Comfort & Kapucu, 2006). In addition, Lindell and Perry (2004) emphasized that risk communication should be a process by which stakeholders share information about hazards affecting the community. This is in consonance with the Sendai framework (United Nations, 2015) of establishing the role of governance and policy vis-à-vis community empowerment with awareness of risk. Risk communication approach should cover the practice of identifying, anticipating and responding to risk situations to

reduce to more acceptable levels the probability of their occurrence or the magnitude and duration of its impacts (Lindell & Perry, 2004).

Tselios and Tompkins (2017) viewed that although the central government may be better placed to respond to disaster-related concerns due to greater access to resources, the role of decentralization affects disaster outcomes. Hence, locally based governments or mechanisms may be better placed geographically and physically to respond to local needs. Moreover, relationship between disaster outcomes and political strategies is affected by the local representation in the institutional framework. Thus, it is critical to understand the role of the institutional framework, its policies and mandate and roles in the risk communication system since they serve as the filtering stations for amplification or attenuation (Kasperson et al., 1988).

The Policies and the Agencies involved in DRRM

The NDRRMP Manual states that the Disaster Risk Reduction and Management Act of 2010 which replaced Civil Defense Act of 1954, provides the legal and institutional basis for its framework. It gives the mandate of a top to bottom structure from the national to the local units or barangay. The National Disaster Risk Reduction and Management Council (NDRRMC) is empowered with the policy-making,

coordination, integration, supervision, monitoring and evaluation functions. Although it is headed by the Secretary of the Department of National Defense, it adopts a multi-sectoral representation comprising of sector ministries, civil society organizations and the private sector. The NDRRMC is replicated at the sub-national levels at provincial being the Local Disaster Risk Reduction and Management Office (LDRRMO), city and municipal levels as the City Disaster Risk Reduction and Management Council (CDRRMC) and at the barangay levels with the Barangay Disaster Risk Reduction and Management Committee (BDRRMC). The LDRRMO provides the technical support to the CDRRMC and BDRRMC (NDRRMP Manual).

Presidential decree No. 1566 enacted in 1978, entitled “Strengthening the Philippine Disaster Control and Capability and Establishing the National Program on Community Disaster Preparedness is one of the National Policies that addresses this concern (Saño, 2010). Consequently, Republic Act 10121 or the National Disaster Risk Reduction and Management Act together with the NDRRMP Plan of 2010 provides the legal basis for policies, plans and programs to deal with disasters (Bustillo, 2017; Boquiren, 2017). By law, the Office of the Civil defense formulates and implements the NDRRMP and ensures that the physical framework, social, economic, and environmental plans of the communities, cities,

municipalities, and provinces are consistent with such plan (NDRRMP Manual). The framework envisions a country of “safer, adaptive, and disaster-resilient Filipino communities toward sustainable development”, with the coverage of four thematic areas, namely: (1) Disaster Prevention and Mitigation, (2) Disaster Preparedness, (3) Disaster Response and (4) Disaster Rehabilitation and Recovery. The National Disaster Risk Reduction and Management Committee (NDRRMC)’s assessment and identification of the flood risk areas are based on the hazard maps developed by different agencies such as the United Nations, and the Meteorological and Geosciences Bureau (MGB) which shows the vulnerable areas for natural hazards in the Philippines. Other sources include: PAG-ASA and Project NOAH (Nationwide Operational Assessment of Hazards) of DOST that constantly monitor the rain levels and weather patterns in the country’s area of responsibility. This allows for the identification of coming typhoons. In the past years, the Philippines had experienced some destructive typhoons which includes Pablo, Pepeng, Santi, Sendong, Ondoy, Yolanda --- which resulted to damage of properties, loss of lives, loss of livelihood.

At present times, the NDRRMP serves as a guide how to carry out: (1) Disaster Prevention and Mitigation; (2) Disaster Preparedness; (3) Disaster Response; and (4) Disaster Rehabilitation and Recovery. It was developed to achieve

“disaster-resilient and safe Filipino communities” (DILG, 2011; ReliefWeb. Int. 2012; WHO, 2011). The NDRRMP base their risk assessments and decisions that determine the Philippines’ vulnerability to natural disasters through multi-hazard maps and constant communication with key agencies. In addition, barangay-based efforts in the Philippines have also been developed in compliance to the NDRRMP mandate through the creation of the Barangay Disaster Risk Reduction and Management Plans (BDRRMP) with the major function of “protecting public and private organizations from any forms of disasters, hazards and other risks”.

Furthermore, the BDRRMCs have been created with organizational structures with stipulated functions at the community levels. Its plans and projects are implemented by the barangay officials or through partnerships with the private sectors, the NGOs, businesses, local and international organizations. As such, pre-disaster activities at the community levels include information, education and communication (IECs) on areas of detecting, communicating, and preparing for disasters (Villanueva, 2016).

Resource mobilization for disaster risk reduction based on the DRRMP Act of 2010 shifted from response-focused into mainstreaming DRR into development policies, planning and programming as well as in climate change adaptation. It also provides a formula for budgetary allocation and

expenditure of the NDRRMC and LNDRRMC funds which states that “not less than five percent of the estimated revenues from regular sources shall be set aside as the Local Disaster Risk Reduction and Management Fund to support disaster risk management activities such as, but not limited to, pre-disaster preparedness programs including trainings, purchasing life-saving rescue equipment supplies and medicines for post-disaster activities and for the payment of premiums on calamity insurance” (NDRRMP Manual).

In compliance to the national law as regards disaster risk and reduction management, the Davao City Disaster Risk Reduction and Management Council is primarily guided by the Philippine Disaster Risk Reduction and Management Act and Plan of 2010 which was developed to address recurring problems related to disasters. It is a fact that several typhoons occur in the Philippines annually and often results to landslides, flooding that destructs property and causes loss of lives. Thus, it is important that environmental, risk and crisis intervention efforts are applied in the best way possible in natural disaster to minimize physical, social and environmental damage.

The Davao City Risk Reduction and Management Council (DC-DRRMC) Units

The Davao City Disaster Risk Reduction and Management Council (DC-DRRMC) was created as provided for in the Philippine Disaster Risk Reduction and Management Act of 2010. RA 10121 laid the basis for a paradigm shift from just disaster preparedness and response to disaster risk reduction and management (DRRM). There are three major agencies involved in disaster-related concerns of the city. These are the Public Safety and Security Command Center (PSSCC); the City Disaster Risk and Reduction Management Office (CDDRMO) and the LIGA-Association of Barangay Captains (LIGA-ABC) of Davao City (refer to Table 4).

The Davao City Public Safety and Security Command Center (PSSCC), used to be the Public Security Command Center (PSC Center) which was in charge of all peace and order concerns in Davao City. After the devastating flashflood of 2011, it was renamed to PSSCC to cover all concerns related to the safety and security of the city including all forms of hazards, disasters and any form of threat. PSSCC is under the supervision of the City Mayor (EO No. 18 2012). It is mandated to provide framework for collaboration, coordination and inter-operability of all offices, agencies and units involved in the safety, security and crime prevention as well as manage the information exchange and dissemination

across its clusters, namely: Davao City Police Office (DCPO); 1003rd Infantry Brigade, Philippine Army (PA); Task Force Davao; National Intelligence Coordinating Agency of Region XI. Parts of these clusters are the sub-clusters which include the Central 911, the Disaster Risk and Reduction Management Office and the Liga-ABC. Specifically, for disaster risk reduction management, the Core Emergency Cluster includes the: 1) Disaster Risk Reduction and Management Office for disaster concerns, involving risk mitigation, preparedness and adaptation; 2) Central 911 for emergency response; 3) City Traffic and Transportation Management Office (CTTMO) for traffic control and transportation; 4) Task Force Davao (TFD) for security measures; and 5) Davao City Police Office (DCPO) for public safety and mobilization concerns. According to a key informant, there is no protocol on how these agencies collaborate with the other agencies on matters related to disaster risk reduction management guided by the comprehensive and central communications system of the PSSCC but at the same time follow their own protocols in the pursuit of their own unit's specific mandate. Despite the lack of an overall protocol, the key informant added that what is important is that each agency knows their respective roles and tasks and effectively communicates with the other agencies under the supervision of one coordinating office.

Table 4

Matrix of the agencies, legal basis and its functions in disaster operations

Agency	Legal Basis	Tasks/Functions
PSSCC	Office of the Mayor Executive Order #18 Series of 2012	<ul style="list-style-type: none"> · Serve as the command, control and coordinating area during daily operations, crisis situations and combined security operations. · Develop, create and operate an alternate command and control unit as the need arises. · Maintain a constant and up-to-date city risk assessment on criminality, terrorism and emergencies.
CDRRM O	RA 10121	<ul style="list-style-type: none"> · Design, program and coordinate disaster risk reduction and management activities consistent with the national council's standards and guidelines. · Facilitate and support risk assessments and contingency planning activities at the local level. · Consolidate local disaster risk information which includes natural hazards, vulnerabilities and climate change risks and maintain local risk map. · Organize and conduct trainings, orientation and knowledge management activities on DRRM at local levels. · Operate a multi hazard early warning system linked to DRR to provide accurate and timely advise to national or local emergency response organizations and to the general public through a diverse communication approach. · Identify, assess and manage hazards, vulnerabilities and risks that may occur in their locality. · Disseminate information and raise public awareness about those hazards, vulnerabilities and risks, their nature, effects, early warning signs and counter-measures. · Establish linkage/network with other LGUs for DRR and emergency response purposes. · Establish a Barangay DRRMO with similar functions and tasks at the community levels.
LIGA-ABC	Sec 491 Local Government Code of 1991	<ul style="list-style-type: none"> · Give priority to programs designed for the total development of the barangays and in consonance with the policies, programs and projects of the national government. · Assist in the education of barangay residents for people's participation in local government administration in order to promote united and concerted action to achieve country-wide development goals. · Serve as a forum of the barangays in order to forge linkages with government and non-government organizations thereby promote the social, economic and political well-being of the barangays. · Exercise such other duties and functions which will bring about stronger ties between barangays and promote the welfare of the barangay inhabitants.

The Davao City Disaster Risk Reduction Management Office (DC-DRRMO) is another agency crucial to the delivery of risk reduction and management concerns at the municipal level. It was established in compliance to the Republic Act 10121 or the “Philippine Disaster Risk Reduction and Management Act of 2010” which is responsible for setting the direction, development, implementation and coordination of disaster risk reduction and management programs within their territorial jurisdiction. The office is guided by the City Disaster Risk and Reduction Management Plan (CDRRMP) crafted by the City Disaster Risk and Reduction Management Council (CDRRMC) where the head of CDRRMO sits as a member. The specific tasks and functions of the DRRMO serve as the implementing guidelines of the national policy in the context of Davao City. It covers the areas of mitigation, preparedness, response, and recovery stages in any disaster which are specifically defined under the National Disaster Risk Reduction Management Plan (NDRRMP) of the Philippines. However, according to the key informants, the CDRRMP of Davao City does not reflect a particular focus on flooding, rather, include all the disaster risks such as earthquake, tsunami, landslides, fire and terrorism attacks. Moreover, the communication strategies do not focus on particular contexts of each disaster, rather, include general considerations for communication inclusive for all types of disasters, both natural

and man-made (Bustillo, 2017; Boquiren, 2017; De Leon, 2017). Based on the documents provided by the CDRRMO, however, the organizational structure reflects five sections such as administration, training, planning and research, operations and warning, and Central 911 response units headed by different persons.

The third agency considered significant in disaster-related concerns is the Liga-Association of Barangay Captains of the Philippines (Liga-ABC). Although the Association of Barangay Captains or Liga as formulated under Sec 491 of the Local Government Code of 1991 under Republic Act 7160 (Arellano Law Foundation, 1991) was originally for the monitoring, implementation and empowerment of the barangay governance, Davao City's Disaster Risk Reduction and Management Council (DRRMC) considered the communities as integral part of the system that handle emergency and disaster cases at the level of their accountability. Thus, under the Executive Order #18, s2012, the Liga-ABC has been considered as one of the sub-clusters for the direct coordination at the level of the communities.

This unit is tasked in awareness raising, monitoring and assistance in line with the disaster and disaster-related concerns which specifically affects the barangays. The president of the Liga sits as a member of the DRRMC of the city. According to the disaster and emergency in-charge (Umpig, 2017), Liga is in-

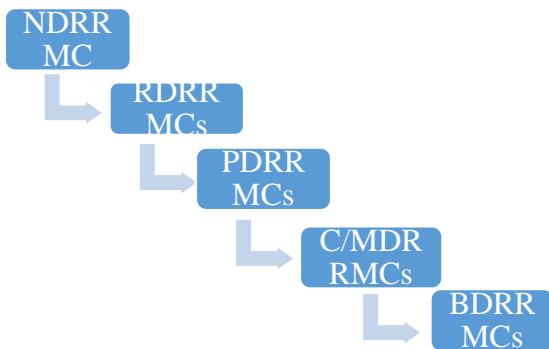
charge of coordinating among the barangay captains of Davao City the concerns that are relayed through their office including projects, plans, and issuances from the Department of Interior and Local Government (DILG). As member, the president is tasked to cover disaster and disaster-related concerns at the barangay level. For instance, Liga facilitated the systematic and organized conduct of this study through a memo sent to the barangay captains of the selected study sites.

The Flow of Communication

Information on disaster risk reduction and mitigation follows a “top-down” approach. Figure 10 shows the organizational set-up of the Philippine DRRM as regards the concerned agencies in compliance to the stipulations as mandated by the RA 10121. Similarly, the bureaucratic flow of communication follows the downward communication flow (Figure 10).

Figure 10

Philippine’s DRRM organizational framework (NDRRMP Manual)



In the case of the barangay level DRRM, the trained community response team is expected to transfer the information to their respective communities. The members of the Community Emergency and Response Team (CERT) in every barangay who are expected to cascade the information to all the members of the community are required to undergo trainings. However, one key informant shared the lack of mechanism that would allow the CDRRMO to monitor how far is the extent of the reach of the transfer of information at the household levels. This is mainly because CERT members are under the supervision of the barangay captains and the purok (zone) leaders. During the FGD, the participants shared that some barangays like Bucana have initiated the participatory approach in warning people about the flooding incidences.

This current structure in the flow of communication was affirmed by the participants in the focus group discussion conducted among the barangay, purok leaders and disaster response personnel. However, it was further learned that the members of the CERT do not transfer the information, but it is the barangay captains who disseminate the messages from trainings or drills through the purok leaders who in turn relay the information to the residents. Generally, the transfer of messages is implemented through the issuance of a memorandum or via oral message using the handheld radios.

The barangay officials and selected residents who attended the FGDs reported that they ensure that during rainy days at the upland flood vulnerable areas, weather updates are closely monitored on the lookout for possible flooding that can affect low-lying communities. They added that barangay efforts to deliver trainings, seminars, and drills for awareness and preparedness are dependent on the availability of resource persons and LGU funds for such purpose. They also rely on the sponsorship of volunteer organizations like schools or non-government organizations to deliver these activities for them.

Majority of the FGD participants also agree that the barangays rely on the information coming from the agencies that serve as the filtering stations. As such, the role of the LGUs, CDRRMO, Philippine Red Cross, some non-government organizations (NGOs) and educational institutions, weather bureau, mass media, the church and the City Information Office play significant roles. All the implementors also confirm that most of the communication flow is top-down whereby all messages originate from the higher agencies and cascaded to the communities.

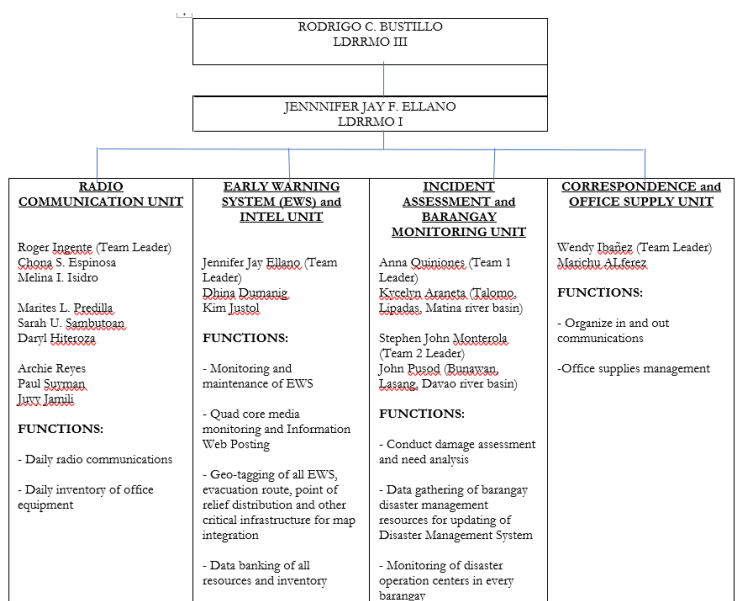
This current one-way flow of information, however, has shortcomings. O’Sullivan et al. (2012) stressed that as long as the communication flow is only a top-down mechanism, change is not likely to happen because it does not give room

for possible engagements. Moreover, some problems caused by political and social dynamics within the government, key agencies and authorities, and the public may also affect efficiency of implementation (Terpstra et al., 2009). Thus, there is a need to examine the role of the agencies and determine if the communication flow is managed according to the protocols specified in the institutional framework. Operationalizing Kasperson's amplification of information is dependent on how the agencies as "filtering stations" use the information, specifically the risk messages involved. An inter-organizational communication system depends on the access to information and the range and quality of information available to operating personnel.

The organizational set up shows that there are four (4) different units under the Operations and Warning Section (OWS) of the DRMMO (Figure 11). These are the Radio Communication Unit, System and Intel Unit, Assessment and Barangay Monitoring Unit, and Correspondence and Office Supply Unit. Each unit is headed by a Team Leader and has specific functions. The interview with the head of the Operations and Warning Section of the DRRMO suggests the interoperability of the different sections to achieve the efficient and effective implementation of their operation. The radio communication unit is in charge of transmitting the daily messages through the radio.

Figure 11

Tasks & Functions of the Operations and Warning Section, DRRMO



The in-charge of the unit ensures that everyone is informed and alerted. For instance, in case of weather disturbance, upon receipt of the information, it is widely disseminated through radio broadcast to all barangays, private institutions, hospital and academe tied up to the base can receive the information on pre- and during disaster eventualities. This is reinforced by the monitoring and maintenance of early warning system, quad core media monitoring and information, and web posting functions of the System and Intel Unit. The third and fourth units are concerned with assessing the needs, monitoring and assessing the damages, and monitoring of disaster operation

center while the fourth unit is in charge of logistics like office supplies management and record keeping.

Generally, the OWS relies on radio communication which links CDRRMO with key barangay officials like barangay captains and the Barangay Disaster Risk Reduction and Management Committees (BDRRMC). The key informant also emphasized that crucial to any barangay level disaster team is the presence of a radio communication system.

Hence, the high-risk areas to flooding are required to set-up a radio communication command unit for faster dispatch of information and efficient management of response actions. The key informant stressed that

“... we already established different protocols especially for communication. We ensure that during disaster one of the vital requirements for disaster management is through communication. So now, one of our protocols is to ensure that all barangay or at least the high risk or hazard prone areas must have their own disaster operation center equipped with radio, cellular phone, and computer.”

Communication Strategies

The challenge in any communication to be effective is the identification of the crucial role of its interdependent elements of source-message-channel-receiver to achieve a successful outcome. In the case of risk communication, the greater challenge is the identification of the target audience as a major

consideration prior to the designing and planning the appropriate methods and channels to relay the risk messages. It is also necessary to identify the relevant information in the different stages of the disaster cycle.

Figure 12 shows the DRRM framework of Davao City with the specific tasks according to the disaster management cycle. The plans and strategies vary based on the different outcomes expected of the agencies. In the case of the risk communication, it is targeted among the most vulnerable communities. Specifically, for flooding concerns, the results of the key informant interviews and focus group discussions reveal that the focus or priority is to address the information campaign among the top five (5) flood vulnerable communities of Matina Pang; Matina Crossing; Ma-a; Tigatto and Bucana as reflected in the Davao city hazard map.

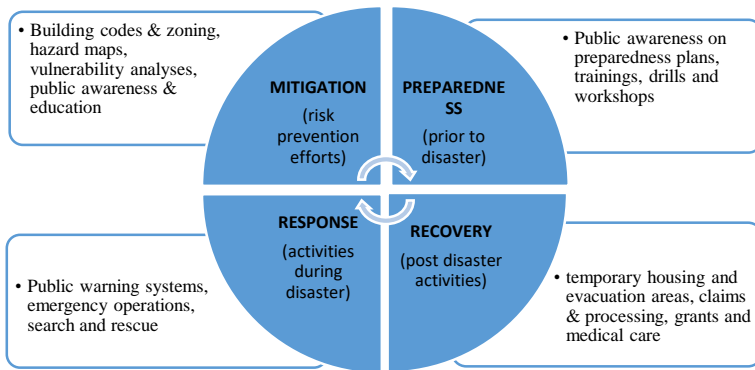
Interoperability of the Agencies

Comfort and Kapucu (2006) emphasized the need for integration as the number of organizations engaged in disaster related concerns. Achieving coordinated action among disparate group of actors depends fundamentally on their access to timely, valid information and their capacity for information search, exchange, absorption, and adaptation. Moreover, Carcellar et al. (2011) stressed the significant role of the interplay of institutional partnerships and inter-

governmental network system that encourages collaboration in the disaster management and risk reduction strategies.

Figure 12

DRRM Framework of Davao City



The PSSCC serves as the center for coordination on matters of public safety with linkages to the following government agencies: (1) Davao City Police Office (DCPO) - on crime prevention, suppression, and investigation; (2) City Traffic and Transportation Management Office (CITMO) - on traffic management and enforcement; (3) City Health Office (CHO) and City Social Services and Development Offices (CSSDO) - on actual and emerging health emergencies and management of victims and emergency shelters; (4) Central 911, Bureau of Fire Protection, Red Cross and volunteer organizations - on all types of rescue services, including fire prevention and suppression, and hazardous materials response; (5) Davao City Disaster Coordinating

Council, Office of the Civil Defense, and Regional Disasters Coordinating Council - on planning and responding during calamities, disasters, and other special events.

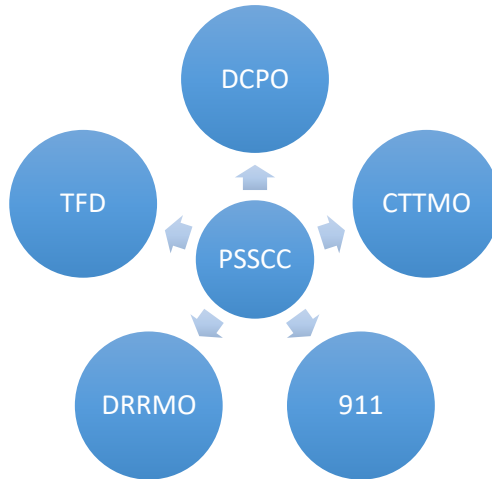
Davao City is known and prides itself for having a Central 911 for its emergency and response concerns since 2002. However, the presence of this center was not sufficient to address the concerns of the Davao City flashflood which struck the Matina area on 2011 that resulted to casualties and damage to properties and disrupted economic activities of the affected areas. This disaster posed a challenge to the current set-up of the City as regards safety and security of its constituents (Cayamanda & Lopez, 2016). Thus, establishing the intertwined role of the 911 vis-à-vis the Disaster Risk and Reduction Management Office under one office is compliant with the US standard for emergency response (Boquiren, 2017).

To perform inter-organizational integration, organizations and systems must be able to interoperate (Kalatzis et al., 2019). Interoperability was first defined by the United States Department of Defense in a 1977 North American Treaty Organization document as "the ability of systems, units or forces to provide services to and accept services from other systems, units or forces and to use the services so exchanged to enable them to operate effectively together" (Kubicek et al., 2011).

Highlighting the value of interoperability in each responder towards any eventuality being handled by the entire network of agencies, Mr. Boquiren visualized the coordination among agencies using a diagram (Figure 13) and highlighted the significant role of the City Mayor, the head of the PSSCC in overseeing and managing the entire operation. The Center has the mandate to maintain and sustain the inter-operability of the different agencies for a better management of communication and related concerns in addressing security and safety of the public.

Figure 13

Interoperability framework of the PSSCC (Boquiren, 2017)



The coordination that takes place in Davao City demonstrates the significant role of interoperability of the agencies working towards the safety and security of the people

from the flood vulnerable communities. As far as the CDRRMO is concerned, the City is prepared and has addressed the problem of communication management at the City level. The City has the necessary equipment, evacuation centers are in place, and the agencies like the City Social Services Department Office and City Health Office know their roles and responsibilities when disasters occur. Despite the preparedness, availability of sophisticated equipment, and plan for worst case scenario, the key informant believed that the best solution is to evacuate the residents of flood vulnerable areas.

The discussion highlights the significant role of the agencies in communicating risk and make people aware and be alert during impending eventualities. It was also mentioned that aggressive campaigns are being done despite the observed lack of manpower and at times funding to implement the strategies to increase the level of preparedness and awareness. Moreover, they have not been able to develop communication tools inasmuch as they could. They have plans of developing localized posters, brochures, and pamphlets, but unable to do so because of limited resources. Thus, the CDRRMO concentrates more on other channels of communication. Significantly, radio communication becomes a major channel, followed by social media and cellular phones to communicate with the key persons at the community levels. Moreover,

CDRRMO relies more “disaster response” through coordination with other agencies like the City Engineer’s Office to access needed heavy equipment and additional assistance from the City Police Department during evacuation.

The CDRRMO, through the key informant, has expressed their appreciation on the role of the academe and other institutions which transform the technical materials into simple messages that can be readily transferred to the communities. He cited the University of the Philippines’ (UP) Project Noah which have popularized the technical information. However, there are missing information that reflect the real situation in the communities. That is where, they rely on the experiential knowledge from the community itself. Direct interaction with the community makes them understand the real-time situations which can help them develop more approaches appropriate to the situation of the flood vulnerable communities. Moreover, there is a need to transform the reactive approach to a proactive approach in terms of disaster and related concerns.

Moreover, the key informant believed that there are still areas for improvement in responding to flooding and other disasters. Specifically mentioned was the need to intensify the information and education communication (IEC) as well as the development of communication protocols to address the transmission of information at the community levels.

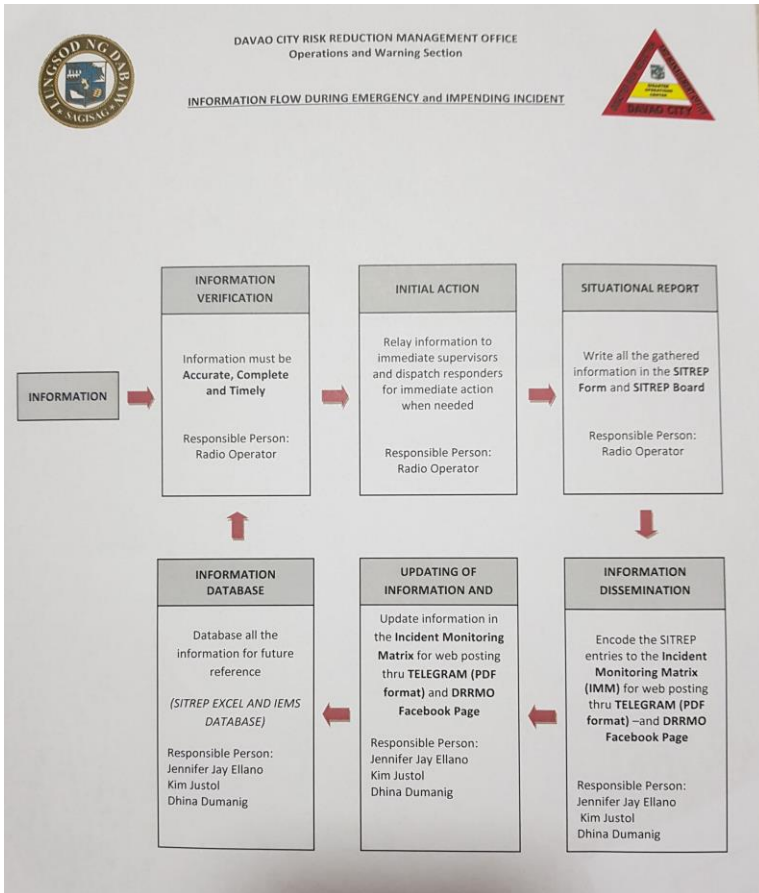
Moreover, these risk messages should be converted from generic messages into localized messages applicable to their context and experiences for better appreciation of the residents. This is where the CDRRMO needs assistance in translating the technical and scientific information for the residents to understand and appreciate. As a result, many IEC materials from the national agencies are wasted. The key informant also shared that national government agencies should “*give us directly what is happening. So kung tumataas ang tubig (if the water level rises, give us the height na... di na kailangan pa na ianalyze pa namin yan (no need for us to analyze the technical outputs) because we have no time to do it*”. The key informant is referring to the automatic weather station and radar from the Department of Science and Technology (DOST).

A critical part of the OWS task is to ensure that credible information is disseminated (Figure 14). Critical to any disaster response is the validity of the information to help the concerned agencies prepare and respond to the emergency or impending incident and not create panic reaction from the public. Hence, the diagram shows the step-by-step procedure to observe and to follow for which the section in-charge is trained. The key informant stated that “*because if you have wrong information it will cause panic.*” The protocol, thus, is considered very important to ensure appropriate and credible

amplification of messages are cascaded to the community where accurate information is most needed.

Figure 14

Protocols for information flow during emergency and impending incident (DC-DRRMO)



Moreover, the communication strategy also involved the identification of the **priority target**, specifically, those areas that experience recurring flooding incidences like those located

near the riverbanks (Figure 15). The results of the recent vulnerability assessment of the DRRMO in collaboration with UP Mindanao revealed that the experts verified that among the disasters and hazards, Davao City is most vulnerable to flooding.

Figure 15

Flood vulnerable communities near the riverbanks, Davao City



Another strategy used is the use of *fear* to amplify the risks of flooding. A key informant reported to have used fear as a strategy to compel people to be responsible and be prepared to any disaster. Some residents can be stubborn and would not evacuate for fear of losing their material possession at the expense of their safety. This is when the key informant tried to amplify the risk with threat and by being aggressive to send the message across. He also mentioned the name of the

Mayor for the residents to accept the responsibility by being vigilant and alert at all times. In addition, citing the law and the importance of compliance to the law as citizens, he stressed that proactive approach can better prepare the communities than the usual reactive stance. Thus, part of his advocacy is to change the mindset of the residents and make them realize the significance of preparedness than emergency response towards any disaster eventuality.

Another strategy is the use of *inter-governmental management*, the theme of amplification of information emerged reflecting that majority of the barangay-initiated seminars, lectures, and trainings were conducted in collaboration with external organizations such as schools and universities, the Philippine Red Cross and NGOs. However, it was expressed that since the activities were dependent on external funding, these initiatives were not regularly conducted which affects the continuity of the awareness and preparedness at the level of the communities. There was also the observed regularity of weather updates during rainfall to give the communities the necessary information for preparation and possible action on flooding incidences.

Communication Tools

Risk communication is a component of risk governance towards disaster mitigation, preparedness, response, and

recovery. Thus, risk communication is usually aimed for making people aware of the risks; improve their knowledge on possible disasters and be prepared; change their attitude towards preparation and changing eventually their behavior. Lindell and Perry (2012) emphasized that the transmission of risk messages is usually based on the classic model of source-channel-message-receiver (SMCR) and that the selection from a variety of tools requires the examination of the target audience for appropriateness and effectivity.

It also follows that when multiple tools are being used for a particular message, consistency and uniformity should be observed to avoid confusion.

Adopting the DRRM communication tool matrix of Georgia, the different tools listed below are categorized according to its usage in the stages of early warning and awareness (CENN, ND). Among the communication tools specified below, the postal or direct mailing is not utilized in Davao city due to the cost that it would entail for the agencies. The discussion of these tools would be further categorized into mass, social and electronic media, visual tools, written tools and interpersonal tools.

Tools	Messages	
	Early Warning	Awareness
Mass Media (TV, Radio, Newspaper)	X	X
Electronic media (WWW, SMS, MMS)	X	X

Tools	Messages	
	Early Warning	Awareness
Audio-visual (video, audio, multi-media, animation, photographs, model, map, slide show, artwork, graphs)	X	X
Postal (direct mailing)		
Stand-alone print (billboard, poster, banner, warning sign, flood water level)		X
Distributor print (leaflet, pamphlet, brochure, booklet, guideline, case study, newsletter, journal, research paper, report)		X
Face-to-face (meeting, seminar, workshop, conference, march, exhibition, demonstration, training, exchange visit, planning)		X
Folk media (story, drama, dance, song, puppet, music, street entertainment)		X
People (community leader, volunteer, project worker, head of sectoral groups, i.e. tribe, women, youth)	X	X

Mass, social, and electronic media

The use of mass, social or electronic media is possible and can be used at all phases of the disaster management cycle as long as communication facilities are not destroyed. It can provide information for preparedness as early warning as well as situational updates during the onset of the disaster (Clerveaux et al., 2009).

In the Philippines, oftentimes, mass media has been the major avenue for the information dissemination at the national level. Hence, majority, if not all, has the access to television,

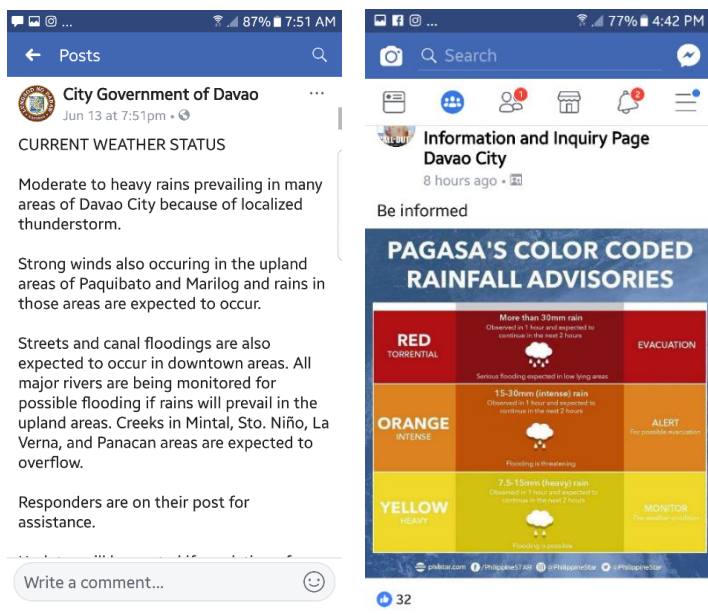
radio or newspapers. In the recent typhoons and storms, it was observed that text messages are also utilized by both the NDRRMC and CDRRMO to give weather updates and warnings for possible typhoons and flooding outcomes.

At the level of the city, the CDRRMO also utilizes electronic media, particularly, the social media like Facebook through the Davao City official FB account or the Information and Inquiry Page of Davao City (Figure 16) to post signage and warnings on flooding to reach wider audience, particularly the youth, in order to update the community on the weather condition and also warn them if there will be flooding.

The key informant, Mr. Bustillo (2017), emphasized the significant role of social media and other forms of electronic communication to relay the information to make people aware and upgrade preparedness level. In all these activities, a strategic approach is to collaborate with other agencies. Not all areas can be covered by the CDRRMO alone and they admitted that the communication efforts should be a collaborative action from different agencies. The text messages of the NDRRMC on weather disturbances and warnings for any flooding and other disasters helped them implement their task of influencing the people of the barangay to prepare and evacuate if needed.

Figures 16

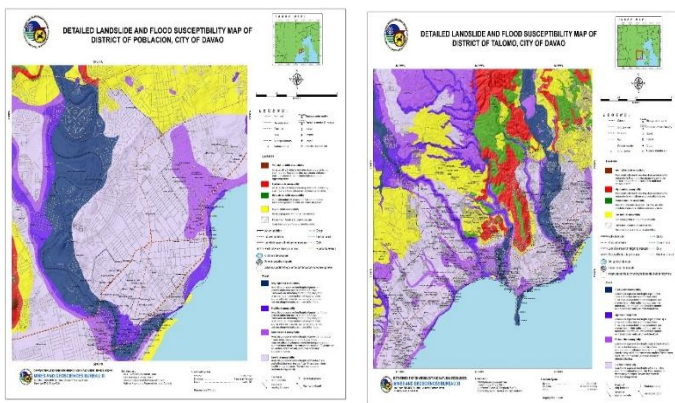
Sample postings on social media



Among the audio-visual tools, the most commonly used are the maps, specifically, the Geographic Information System (GIS) to identify the most vulnerable communities. The GIS outputs are hazard maps which vividly capture the level of risk of flood prone areas (Figures 17). Similarly, a hazard map from the DOST which captures the 100-year rain return flood hazard map for the visualization of the possible flooding and flashflood incidences.

Figures 17

Sample hazard maps utilized by the CDRRMO



Visual tools

Among the stand-alone prints, results of the KIIs and FGDs revealed that all the tools under this category are being used as billboards, posters, banners, warning signs and flow water level. Specifically, the DRRMO uses the communication tools provided by the national agencies such as Philippine Atmospheric, Geophysical and Astronomical Services (PAGASA); Department of Interior and Local Government (DILG), and NDRRMC. Examples of these are attractive color-coded rainfall warning (Figure 18) and storm warning system posters (Figure 19). At the barangay levels, signage are also used to give vital information and warnings (Figure 20).

Figure 18

Rainfall warning (DRRMO)

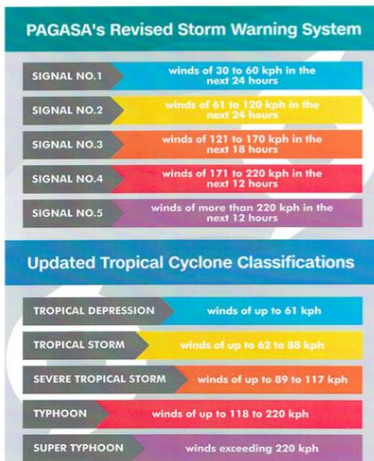


Figure 19

Storm warning system (PAG-ASA)

Figure 20

Signage in the barangay



The key informant expressed that the shortage of personnel in-charge delimits the creation of more local communication tools. The DRRMO relies more on the reproduction of materials from the national agencies for dissemination to the communities and warn them to prepare for any eventuality posed by flooding in the areas. Incidentally, brochures or flyers are also being distributed among the barangays as they receive them from the national agencies. However, due to limited number of copies, the CDRRMO prioritized the flood vulnerable communities. Some barangays with sufficient budget allocation may reproduce these materials to augment the copies coming from the CDRRMO.

Written Tools

For distributor prints, it was found that the most commonly used are brochures (Figure 21), flyers, leaflets and posters (Figure 22). Although there have been studies conducted about flooding and disasters in the area, case study, research report and other academic papers are mostly utilized only by the implementers for review, when necessary.

These materials from the national agencies are usually converted into billboards or signage for distribution to offices, schools and areas for the entire community to see.

Figure 21

Sample brochure (DENR)

Dahil sa bilis, lalabas at walang latsyalang indikasyon kung kailan ito magaganap, isa sa pinsakadelikadong uri ng baha ang "FLASHFLOOD". Karaniwan ang flashflood sa lugar na may sanga-sangang sapa at ilog. Sa maikling oras ng malalakas at tuloy-tuloy na pag-ulán, bigla ang paghahas ng tubig na hindi nakakayanan saluhin ng mga natural nitong daluyan.

Ang nang kamandag sa Pinakian, Paraan Island sa Leyte na dinaranan ng flashflood noong Dec. 2003 at ang mga sanga ng sapa sa kabundukan

Ang baha ay hindi lamang dulot ng malakas na pag-ulán. Sa ating tanaw, nangyari na ang mga pagbaha dahil sa tsunami, pagkasira ng dam, tidal change at ang pagtasas ng tubig mula sa buhangang ng bulkan. Ang mga ito ay ilan lamang sa mga halimbawa ng pagbaha na hindi nakaayos sa taya ng panahon o lakas ng ulán.

Matagal na natim napapakunahangan ang mga 'structural at engineering measures' sa pag-kontrol ng baha. Layunin nito na maliban ang epekto ng baha sa ating komunidad ngunit may hangganan din ang kalayuhan ng mga utakturang ito at lubhang may lamahalan.

Ang mga komunidad na may banta ng pagbaha at flashflood, mahalaga na tayoy palaging handa.

Huwag manirahan sa mga lugar na delikado sa baha at flashflood

Alamin parati ang taya ng panahon

Nagkakaibang mamamayan sa pangangalaga ng kapaligiran

Disaster management system ay pagtingin sa inyong lugar. Makitahaagi at maging aktibo sa mga gawain ukol sa paghahanda

Alamin ang mga itinalagang evacuation site sa panahon ng emergency

Maaring alamin sa Mines and Geosciences Bureau at mga Regional Offices nito ang flood susceptibility sa inyong lugar. Magtanong ukol sa GEOHAZARD MAP (ang mapa na maghahayag ng impormasyon sa lugar ng inyong lugar sa iba't-ibang uri ng geohazards tulad ng pagbaha at flashflood).

BAHA

Ilang Kaalaman at Paraan sa Paghahanda at Pag-iwas

Ang Flood Susceptibility Map sa Cabanatuan City, Nueva Ecija

Sa iba pang impormasyon at mga katanungan, makipag-uugnayan lamang sa aming mga tunggapan

Kung ang BAHA ay darating, Pinalsa'y huwag nang palalimin!

Department of Environment and Natural Resources
MINES AND GEOSCIENCES BUREAU
North Ave., Diliman, Quezon City
Tel: 920-8642, 920-9120
Fax: 920-1635
Email: central@mp.gov.ph
Website: www.mgs.gov.ph
December 2006

Figure 22

Sample poster (DC-DRRMO)

CITY GOVERNMENT OF DAVAO
DISASTER RISK REDUCTION AND MANAGEMENT OFFICE

KNOW THE EMERGENCY
ALERT SIGNAL OF DAVAO CITY

SIGNAL	MEANING	ACTION
ELECTRONIC SIREN		
Wavering tone for 3 mins	Imminent possible disaster such as Tsunami, Storm Surge, Strong Wind or Flooding	Orderly EVACUATE to your designated Safe Evacuation Area and listen to Radio Stations/ Alert Text Blast for Instructions
Steady tone for 3 mins	All danger, drill or exercise is CLEAR	Return to normal activities or if evacuated, safely return to your houses
Steady tone for 30 secs	Testing Sound	Testing every Tuesday at 12 noon
MANUAL BELL		
Continuous dings for 3 mins	Imminent possible disaster such as Tsunami, Storm Surge, Strong Wind or Flooding	Orderly EVACUATE to your designated Safe Evacuation Area and listen to Radio Stations/ Alert Text Blast for Instructions
2 repeating dings for 3 mins	All danger, drill or exercise is CLEAR	Return to normal activities or if evacuated, safely return to your houses

For more information
Call Disaster Risk Reduction and Management Office
Tel No.: 295-2387 or 296-9626 local 211
Or coordinate with your Local BDRRMC

Other materials for dissemination to raise public awareness on the risks of flooding and other natural disasters include posters and brochures. However, due to limited number of copies, the CDRRMO prioritized the flood vulnerable communities. Some barangays with sufficient budget allocation may reproduce these materials to augment the copies coming from the CDRRMO. Other signage or markings are placed in structures like the pillar of the bridge to reflect real time water level. The FGD participants validated the distribution of the communication tools from the NDRRMC and CDRRMO, however, majority of them explained that they cannot develop nor reproduce communication tools due to limited manpower and budget. Surprisingly, the same FGD participants have plans to improve their DRRM communication strategies by: 1) developing communication tools and intervention strategies for persons with disabilities (PWDs), senior citizens; 2) collaborate with volunteer groups and sponsors for a disaster-resilient community in terms of infrastructure and community-based disaster response protocols; 3) activate purok disaster teams (PDaTs) and Community Response Teams (CRTs); and 4) develop more aggressive awareness campaigns and not rely only on “experiences” to respond to disaster situations like flooding.

Interpersonal Tools

A key feature of the interpersonal communication approach is the use of oral communication which allows the immediate response and feedback mechanism.

The CDRRMO utilizes the face-to-face interactions during seminars, trainings and workshops to help the communities recognize the gravity of the impact of flooding and other disasters. The planning and research staff transform the technical information into simple communication materials using layman's terms for ease of understanding of the people. Moreover, the modules for capacity building include the results of the needs assessment conducted by the research staff as well as the experiences of the people. The key informant finds the face-to-face interaction to be more effective than any other means of communication because people appreciate being asked of their situation that somehow ensures positive reaction to be prepared and cooperate for the follow-up activities through constant radio communication. Other forms of interpersonal communication include word-of-mouth, house-to-house visits and community assemblies which encourages transactional approach and encourages the immediate response or action to the messages. Results of this study show that at the onset of flooding, the use of word of mouth among the residents as regards warning and emergency messages becomes the basis for evacuation response.

For the FGD participants, utilizing all forms of communication from formal media such as TV, radio, signage, posters, brochures, pamphlets to informal channels like word-of-mouth, and social media should be explored. In terms of the timeliness of the warning signals during the onset of flooding, they reported that house-to-house and roving of in-charge using megaphones is a reliable and important tool.

Based on the above discussions, operationalizing the “ripple effect” can be observed through the transactional process and communication channels involved in the DRRM of Davao City. Finally, the key informant added that communicating risk and preparedness should be a continuous effort to sustain the community’s motivation to be alert and prepared at all times.

According to one key informant (Bustillo, 2017), communication is critical in managing disasters. At the onset of the flooding incidents, radio communication plays a role to disseminate information and warnings to the communities that may be affected. During flooding, the cellular phones and megaphones become alternative channels to disseminate warning and to inform concerned agencies of the real-time situation at the community levels. It was, however, emphasized that communities should be capacitated to respond to flooding. Since there are situations that require quick response

and it would be an advantage if communities are better prepared. He stressed that:

“communication is a vital tool in disaster management. One cannot communicate if you don’t know how to reach out to these people. We have to identify team leaders and volunteers to coordinate as responders at the community levels. Not all the time the Central 911 can respond immediately since sometimes there are cases of simultaneous emergency and disaster incidents. Communities must be organized to respond to their own situation and not rely solely on 911 responders.”

This particular emphasis on community preparedness and communication management puts priority on the community’s capacity to strategize and develop its own initiatives to consider the importance of social networks and collaboration among individuals in the community.

Audio tools

In terms of the audio tools which serve as critical to disaster preparedness and response, the interviewee reiterated the significance of radio communication as the priority channel and part of the disaster funds of each barangay is for the purchase and set-up of a radio communication center. It does not only serve its purpose during disaster and emergency response rather, it also become a vital tool for faster and wider scope of information dissemination across the communities, the concerned agencies and among the volunteer organizations

that respond to any disaster or emergency. Furthermore, it is more sustainable at the community level due to its low maintenance and easy to operate compared to cellular phones. Moreover, there is also the common usage of loudspeakers, specifically during early warning signals among the communities. Since communication is critical during emergency situations, the most commonly used are the audio materials like radio communication, loudspeakers, siren or alarm, and ring tunes.

Communication Messages

Messages for awareness

The study revealed that trainings and seminars involved topics that helped them become aware of the risks and hazards of disasters like flooding, earthquake, fire, tsunami and even climate change. In most cases, discussion of disasters does not specifically focus on flooding, rather, it is discussed in the context of natural disasters which encompasses all the other disasters. Hence, there is the lack of emphasis on flooding concerns which the flood vulnerable communities need. Drills, on the other hand, are geared towards capacity building among participants on what to do to prevent, mitigate, act upon and rehabilitate after a disaster. Moreover, awareness of the early warning system being implemented within the community such as the alarm signals, flood water monitoring and typhoon

warning signals. Other topics include the guidelines for evacuation when necessary and the parameters for emergency response. It was, however, emphasized by the residents that some trainings and seminars focus more on utilizing visual aids and materials that are using technical terms and sometimes resource persons at the barangay level cannot simplify it and thus become irrelevant to them due to confusion and lack of appropriate understanding of the message. Moreover, the seminar speakers rely on the materials from the national agencies in terms of typhoon warnings, hazard identification and evacuation guidelines. Some items were not directly targeted to their specific context. One instance cited by one of the residents of Matina Pangi, an area vulnerable to both flooding and landslide, is the difficulty of identifying which is more dangerous and riskier, landslide or flooding. Since seminars discuss landslide and flooding separately.

Messages for preparedness and warning

The implementers have identified preparedness intervention such as drills for emergency response and alert level parameters, rescue and recovery mechanisms and first aid information. The implementers and residents agree that aggressive campaign should be done to disseminate information on preparedness and warning as part of the pre-disaster stage so as to capacitate the communities for early

detection of danger signs and voluntarily respond accordingly without waiting for instructions from the concerned agencies. However, the nature of the messages being given through the tools for this purpose, does not reflect the specific guidelines for any disaster or eventuality. In most cases, drills and trainings focus on first aid, basic life saving techniques and medical response. Basic preparedness and warning that the households can use for emergency situations are information about safety and timeliness of response to any disasters. Some residents highlighted that at the onset of flooding occurrences, they rely more on their previous experiences and information by word of mouth in terms of validity of emergency information. In most cases, information about directions where the evacuation centers are located becomes the highlight of the messages addressing preparedness and warning. Although they are familiar with the usage of siren/alarm and loudspeakers to alert them when flooding occurs.

Barriers and Challenges

However, in terms of the residents' reception of the CDRRMO efforts, the key informant emphasized that it cannot be avoided that despite the efforts to have an inclusive training and preparedness enhancement, some residents would be resistant to the idea, capitalizing on the fact that their experience and length of stay in the area have given them

sufficient knowledge and can help them prepare for any eventuality. To this, he specified that at times, there is a need to amplify the risk to change their mindset to listen and heed to warnings of the PSSCC. For instance, the key informant capitalized on the casualties and damage to properties of the 2011 flash flood in Matina to emphasize the risk and the gravity of disasters, which exemplifies Kasperson's idea of risk amplification. Through giving vivid examples with negative outcomes, the source of the message, CDRRMO, attempts to change the mindset from complacency to a proactive stance to make the people more receptive to the risk messages and be mindful of the possible negative impacts of the disaster that they thought as a regular occurrence. One interviewee also emphasized the lack of sufficient personnel and limited resources to help them perform this task for a wider reach of their messages. Hence, they rely on cascading the knowledge and information from the barangay officers to the households through the trained purok leaders and provision of posters. This practice also shows the possible problems when the trained officials who are expected to transmit the messages do not deliver and cascade the information to the communities. It also creates problems when the residents themselves prefer not to participate for whatever reason as reported by a member of CERT. Sometimes, this non-participation is translated to non-reaction to evacuation orders during flooding.

Admittedly, the key informant aired the problem with illegal residents in danger prone areas who are stubborn but cannot be ignored during flooding. He added that as a disaster manager, he is recommending to totally relocate the households living within the waterways and the mangrove areas that are easily affected during monsoon. Simply put, some problems of these flood vulnerable communities are brought about by the conditions as consequence of poverty. Contributory factors to the vulnerability of these communities are their decision to stay in the areas despite the awareness of the risks and dangers associated with their settlement in these areas. In this case, the only proactive strategy is to upgrade early warning devices and enhance awareness and preparedness of the residents to minimize the impact of disaster.

The key informant also reiterated that everything about disaster and related concerns would be efficiently managed with the cooperation and systematic coordination among the agencies involved, volunteers, and the community at large. The Local Government Units (LGU) may be at the forefront but it needs the assistance and cooperation from other agencies and the community as well to be able to deliver efficient services and have positive outcomes. The implementers also expressed that there were constraints encountered by the barangays that affect the implementation of the risk communication at the

community levels. It was observed that the limited personnel to assist the BDRRMCs prohibits the continuity of the programs. Majority of the participants agreed that there is still the need to further enhance the planning and development of the strategies and utilization of the tools. Some barangays also need a more defined warning system and additional equipment and facilities like hand held radios, siren, or alarm. It was also mentioned that structural interventions in the bureaucracy affect the urgent dissemination of messages. Thus, there was the suggestion of a more defined policy or barangay ordinance on this matter. Other suggestions from the implementers at the barangay level include: more aggressive awareness and preparedness programs, involve the youth and women in the planning and implementing strategies, as well as develop communication strategies for the persons with disabilities (PWDs) and senior citizens by documenting the experiences and practices and share among the flood vulnerable communities. For specific DRRM strategies, there is a need to review the existing policies or guidelines and develop a more defined and policy-oriented risk communication at the community level. Lastly, majority also stated that there is a need to develop a ready reference master list to prioritize the vulnerable groups and re-activate the purok disaster assistance teams (PDATs) and community response teams (CRTs). However, on the long-term plan, most of the implementers

agreed that there is a need to review the land use plan of the city as well as relocate the residents of the highly vulnerable areas to flooding, specifically, those on the riverbanks.

In describing the communication system, two major themes have been observed among the participants of Set B comprised of the residents of the flood vulnerable communities, as follows: (1) communication efforts reflecting the current activities and programs being implemented at the community level, and (2) protocols observed in the structural flow of communication. With regard to the communication messages, sources and channels of communication, there were six themes identified as: (1) topics and messages of lectures and trainings, (2) types of messages relayed to the communities, (3) sources of the information, (4) media used to communicate information about flooding, (5) timeliness and appropriateness of the communication; and (6) target audience of the messages. All the barangay implementers revealed that disaster risk trainings and seminars involved topics about risks of disasters like earthquake, fire, tsunami, and flooding and how to prepare on these eventualities. It also covers emergency response and alert level parameters, information about warning signals which include alarm systems and color coding on water level signage, preparation for disasters, including guidelines for evacuation and first aid. The communication tools enumerated include signage, posters, water level coding, seminars, lectures,

and drills during pre-disaster situations. The use of mobile phones, hand held radios, megaphones, use of siren and even house-to-house information campaign during disaster situations and incident reports and documentation of post disaster meetings for post disaster situations. However, it was also mentioned that word-of-mouth and social media were being used for message dissemination at different stages of the disaster cycle.

The participants from Set B (residents of flood vulnerable communities) agreed that although there are programs and efforts for the awareness and preparedness of the flood vulnerable communities; majority of them expressed that the following areas can still be enhanced and strengthened.

a. Management of risk communication. There is a need to encourage participatory and inclusive approach to address the concern on gaps in message dissemination, the relay of messages must reach all the affected households and not only those that have members who are active in disaster concerns. In terms of limited distribution of materials, it was suggested that if majority of the residents can attend assemblies and participate and, in the planning, and conceptualization stage, information can lead to wider dissemination of information. It was also stressed that programs and activities on risk reduction at the barangay level is not sustained due to lack of funds or personnel. This can be addressed if sectors like

the youth, the members of the household who stays at home and other volunteer groups can be tapped to help augment manpower shortage. Moreover, encourage that majority, if not all, of the residents should be involved in the awareness and preparedness activities. Similarly, to recommend a policy that will ensure funds and programs are geared toward this initiative since it was also reported that some barangay officials neglect or do not prioritize risk reduction management and efforts are not optimized. Some barangays have the interest to pursue risk reduction initiatives but lacks the appropriate knowledge and skills to do so, thus, collaborating with other agencies, institutions, academe and volunteer groups can be an alternative. Lastly, results of the study also revealed that there is no risk reduction program which particularly address the needs of the PWDs and Senior citizens, which are considered highly vulnerable to flooding.

b. Tools and messages. Results of the study revealed that efforts can still be maximized to ensure a more participatory approach. Trainings, seminars and drills should encourage more participants other than those assigned to monitor disaster eventualities. There is also a need to add more signage and posters for warning and evacuation information. Another area is the insufficiency of equipment for warnings and alert messages, some FGD participants emphasized that the sirens, although placed in strategic locations, cannot reach

the entire community at risk. Thus, there is a need to add more siren, megaphones and hand-held radios for the barangay implementers. Some information materials are highly technical for the residents and to address key gaps in understanding the information on the materials being utilized, simplification of messages according to “layman’s” context is necessary. Another strategy is for regular community meetings be done to discuss experiences and sharing of practices on flood responses as well as develop quick reference on what items to prepare in evacuation eventualities, what to do when flooding occurs and additional safety tips at the household levels that they can easily implement, and information about evacuation

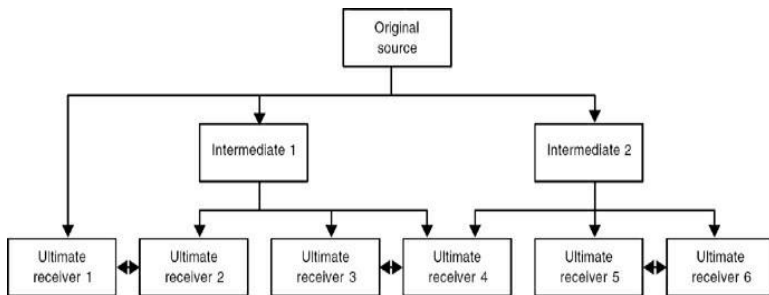
Summary

Lindell and Perry (2004) emphasized that risk communication should be a process by which stakeholders share information about hazards affecting the community. In consonance with the Sendai framework (UNDRR, 2019b) of establishing the role of governance and policy vis-à-vis community empowerment with awareness of risk, risk communication approach should cover the practice of identifying, anticipating and responding to risk situations to reduce to more acceptable levels the probability of their occurrence or the magnitude and duration of its impacts (Lindell & Perry, 2004). Consequently, risk communication must be represented by a network (Figure

23) where there are multiple sources linked to the ultimate receivers through intermediaries that receive the information and relay it to the ultimate receivers. The image below captures the existing communication system and protocols being observed by Davao City. NDRRMC or PAG-ASA being the original source, DILG being the intermediate 1 relays the information to LIGA-ABC, PIA and PSSCC; the Office of the City Mayor as the intermediate 2 relaying the information to PSSCC, OCD and RDCC while CDDRMO being the ultimate receiver 1 coordinates with PSSCC to ensure relay of information to response units like the 911 and CHO.

Figure 23

Communication Network Model (adopted from Lindell and Perry, 2004)



The examination of the communication systems and protocols of Davao City revealed that a “top-down” implementation is observed depending on the hierarchy of the agencies involved which validates findings of previous studies that examine risk communication from the perspective of the

implementers (Haer et al., 2016; Lazrus et al., 2015; Leelawat et al., 2015; Kubicek et al., 2011; Comfort & Kapucu, 2006; Comfort et al., 2004). In this particular case, disaster or risk messages or materials come from the NDRRMC, cascaded down to the concerned agencies the City level i.e. DILG, CDRRMO and City Mayor's Office then cascaded down to the barangays through the BDRRMC and barangay captains sent to the household levels through the purok leaders. It is, however, noted that lateral communication between agencies is involved. The inter-operability of the agencies at the City level made communication more efficient and reliable. In terms of information transfer, this is usually done through radio communication and is expected to have its "ripple effect" to other concerned agencies until it is cascaded to the communities. Moreover, it was found that despite the observation of the formal channels of bureaucracy, there is also the use of the social media, word-of-mouth and text messages in the dissemination of the information.

Results of this study put emphasis on building community resilience utilizing effective information dissemination and dynamic community-based preparedness that would lead to better disaster mitigation strategies. Communication protocols, coordination as well as control should be observed at these critical situations as pointed out by Comfort et al. (2004) and Comfort (2007). Similarly, it also

concur with the findings of previous studies that highlight the 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, 2006; Australian Red Cross Report, 2013; Oh et al., 2014). The interplay of roles of the varied organizations, including the NGOs and international volunteer organizations should be focused on implementation rather than conceptual levels (Christoplos et al., 2001; Comrie et al., 2019). Moreover, Reid (2015) argues that it is also best to explore the community-based adaptation measures that will have significant contribution to building more resilient communities as it is ‘a community-led process, based on communities’ priorities, needs, knowledge and capacities, which should empower people to plan for and cope with the impacts of climate change’ and disasters like flooding. 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. Moreover, the Australian Red Cross (2013) reported that 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. Furthermore, emphasis on areas to work on should be at the forefront of discussion and decision

among key players, i.e., LGU, development-oriented group, to encourage a strong community/participatory focus and long-term perspective must be central to any development initiatives.

B. Vulnerability Profile and Risk Related Behavior of the Communities

Past direct and indirect disaster experiences invoke preparedness intention and actual preparedness for flood hazards at individuals, communities and organizations levels (Ejeta, 2019). Ejeta (2018) also stated that 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 (Grothmann & 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). Grothmann and Reusswig (2006) 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.

This section describes the vulnerability profile of the respondents, their awareness and perception on the risks of flooding, and their assessment of the risk communication system of Davao City. The data came from the survey of 353 respondents who were randomly selected using a multi-stage cluster sampling. The survey was conducted in the top five (5) flood vulnerable barangays identified by the Davao City Risk Reduction and Management Center with a total population of 6177. The total sample interviewed was 376, however, only 353 questionnaires were processed due to many incomplete entries. Results of the key informant interviews and focus group discussions were also integrated to provide an in-depth explanation of the patterns emerging from the survey.

Data were analyzed using frequency distribution, ranking, graphs, and correlational analyses using R statistical software and Microsoft Excel. Specifically, the Spearman's Rank Order Correlation was used to determine the relationship between the socio-demographic and economic factors and the respondents' awareness and perception on the risk communication system of Davao City.

Vulnerability Profile of Respondents

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 5 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 5, 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 (e.g., CSSP, 2008; Mallon, et al., 2013; Stough, 2015; Wisner, et al., 2003 as cited in Howard, et al., 2017) 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.

Almost half of the respondents are engaged in contractual type of work followed by those who are self-employed (25.5%). The contractual workers are laborers, drivers, salesclerks, household helps, school janitors, and canteen servers. These less-secured types of work are characterized as seasonal, high turnover rates, and low paying (Sauter, Comen and Stebbins, 2017). Based on the income categories of the Bureau of Internal Revenue (BIR) (2017), more than half of the household of the respondents earn PhP10,000 or less followed by 43.6% who were earning PhP11,001-PhP30,000 per month. Only 5% of the respondents earned more than PhP30,000 or more per month.

Table 5*Distribution of respondents by vulnerability characteristics*

Characteristics	F	%
Age Group		
Young	5	1.4
Middle-aged	189	53.5
Old	141	39.9
Senior Citizen	18	5.1
Sex		
Female	285	80.7
Male	68	19.3
Educational attainment		
No Education	3	0.8
Elementary	67	19
High School	187	53
College	81	22.9
Vocational	15	4.2
Civil Status		
Single	27	7.6
Married	223	63.2
Live-in	55	15.6
Widower	37	10.5
Separated	11	3.1
Religion		
Roman Catholic	239	67.7
Islam	32	9.1
Others*	82	23.2
Occupation		
Contractual employee	175	49.6
Self-employed	90	25.5
Private employee	18	5.1
Government employee	12	3.4
Not employed	58	16.4
Gross Household Monthly Income		
10,000 and below	185	52.4
Above 10,000 – 30,000	154	43.6
Above 30,000 – 70,000	8	2.3
Above 70,000 – 140,000	6	1.7
Total	353	100

*Note: Other religious affiliations include Protestants, Adventists, Baptist, Church of Christ, Iglesia ni Cristo

Number of years residing in the area

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. 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 (Carillo, 2015), until 2017 (Figueroa, 2019); however, flooding happened again 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). Perez (2016) emphasized that 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. In addition, Revita (2018) mentioned that 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) and mounting garbage (Revita, 2018).

Table 6 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.

Table 6

Distribution of respondents by years of residence and housing characteristics

	F	%
Years of residence in the Area		
0-10 years	127	36
Above 10 years to 20 years	115	32.6
Above 20 years to 30 years	57	16.1
Above 30 years to 40 years	28	7.9
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	
Ownership		
Owned	208	58.9
Rent-free	94	26.6
Rented	51	14.4
House Type		
Improvised	223	63.2
Single One storey	69	19.5
Single Two-storey house	53	15
Attached row house/apartment	8	2.2
House material		
Mixed materials	249	70.5
Concrete	64	18.1
Wood	18	5.1
Light materials (amakan)	22	6.2
Total	353	100

Flooding experiences

This section presents the experience of the respondents. This covers the experience in terms of depth of flooding and its causes, effects of flooding, and their response on flooding.

Depth of flooding. Table 7 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.

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), and 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."

Table 7

Distribution of respondents by frequency, depth and cause of flooding

Item	F	%
Frequency of Flooding		
Always	5	1
Frequently	61	17
Occasionally	172	49
Rarely	74	21
No experience	41	11.6
Depth of flood water		
More than 4 ft.	208	58.9
2-4 ft.	31	8.78
1-2 ft.	59	16.7
Less than 1 ft.	16	4.5
No experience	41	11.6
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	13.6
Strong typhoons	34	9.63
Climate Change	10	2.83
Poor urban planning	8	2.67

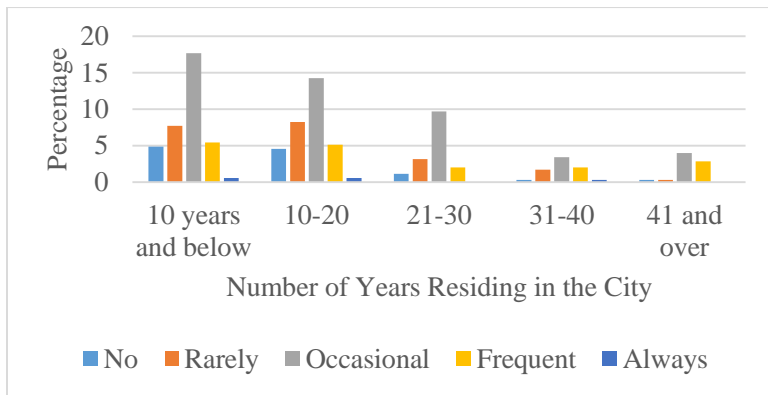
**Multiple response*

Figure 24 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).

Figure 24

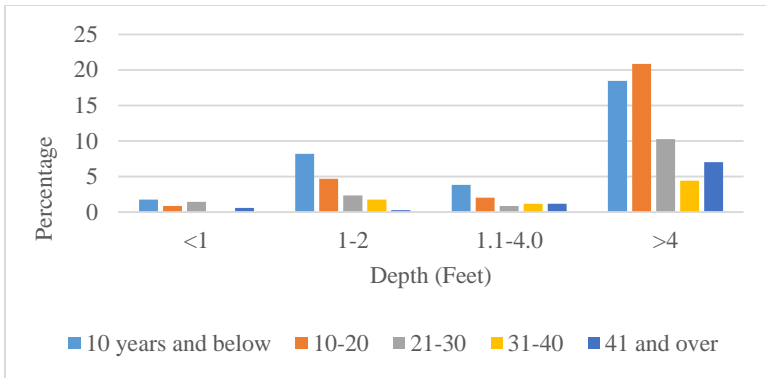
Percentage distribution of respondents by number of years residing in the area and occurrence of flooding



Flooding occurrences in Davao City as reported by majority of the respondents are occasional but heavy. Moreover, heavy flooding occurs in the last 20 years. Figure 25 shows that regardless of the number of years residing in the City, majority of them reported to have experienced flooding more than four feet deep. This is particularly true for those who have been residing in the area for 10 to 20 years.

Figure 25

Percentage distribution of respondents by depth of floodwater and number of years residing in the area



Effects of Flooding. The residents of the flood vulnerable areas reported that flooding heavily damaged both households and communities. Table 8 summarizes the effect of flooding to households and the community. Majority of the respondents consider disruption from work (23%), damaged the houses (23%), and disruptive schooling of their children (20%) as having the greatest impact among residents. For instance, some survey respondents mentioned that the most recent flooding of December 22, 2017 resulted to evacuation of residents and forced them to celebrate Christmas season at either the evacuation centers or houses of relatives or friends. Moreover, disruption of their work for at least two weeks meant no income for daily earners. Eighteen percent (18%) of the respondents have reported the other effects of flooding

which are emotional and psychological. The FGD participants shared to have been emotionally and psychologically affected brought about by panic and fear, dirty environment, muddy and inaccessible roads, and foul smell due to scattered garbage. There were also reported of damaged crops and dead livestock. The effect of flooding is further worsened by their low income as majority of the respondents have a monthly household income of Php10,000 and below.

Heavier damages were mentioned in several reports including UCANEWS (2011), Maxey et al. (2013), Carillo (2015), Revita (2018) and Figueroa (2019). For instance, the 2011 flashflood was worst where 25 people, including 14 children were killed and affected up to 12,700 families (International Federation of Red Cross and Red Crescent Societies, 2011).

Table 8

Distribution of respondents by effect of flooding to households and community

Effect	F	%
Disrupted work	217	23.4
Damaged houses	216	23.3
Disrupted school	188	20.3
Dirty environment	170	18.4
Damaged crops	64	6.9
Drowned animals	71	7.7

Note: Multiple response

Results of the survey showed that majority (81.7%) of the respondents in the flood-vulnerable communities were

amenable to relocate (Table 9). However, the results of the focus group discussion with selected households have differing opinions regarding relocation. They shared that they cannot move to other areas because it is expensive to build house, aside from the sentimental reasons attached to and familiarity with the area. They also considered that their current location is strategic in terms of their workplace and school for their children. These sentiments are similarly found in the findings of Mercado (2016) which revealed that residents of Baseco in Manila remain in their residences despite the knowledge of disaster risk and possible damages to property and loss of lives. It should be noted that there are also respondents living in the identified flood vulnerable barangays who do not consider their area as vulnerable to flooding and yet 45.3% of them were also willing to relocate. This contradictory finding of results from the quantitative and qualitative data emphasized Creswells’s idea of divergence which requires further exploration in future studies to validate and identify underlying factors that may have affected the contradiction.

Table 9

Distribution of respondents by perception of area as flood vulnerable and willingness to relocate

Area of residence is flood vulnerable	Willingness to relocate			
	NO		YES	
	F	%	F	%
No	34	53.1	53	18.3
Yes	29	45.3	236	81.7
No Answer	1	1.6	0	0
Total	64	100	289	100

These results affirm the significance of some initiatives from other parts of the Philippines on building disaster-resilient communities that aimed to reduce community vulnerabilities to disasters by incorporating DRR into their community development programs. As of 2010, the pilot projects have introduced early warning system, vulnerability reduction and social protection and participatory disaster-responsive governance. Some of the documented initial projects in the Philippines have shown that the more participatory the community and stakeholders are, the higher is the assurance of effectiveness (Dela Cruz et al., 2010).

Response of households to flooding. Nearly half of the respondents prepares for the possible effects of flooding once the rain falls (Table 10). Meanwhile, more than 30% of respondents only prepared when the floodwater is already high. These responses are very risky because as reported by the BPI and WWF (2013) flooding in Davao City is caused by the rains in the upland. By the time that the residents are ready to evacuate, floodwater could be very high making it more difficult to get out of the community. This has been observed during the 2011 flashflood in the Matina and nearby areas of Davao City, resulting to 29 deaths and destruction of properties (Cayamanda & Lopez, 2018).

The family and relatives of the respondents were the main reason (52.13%) for the respondents to prepare for the

floods. When probed further during the focus group discussion on what particular preparations they do when there is threat of flooding, answers vary from stocking of food in case they are stranded at the second floor of their house; packing necessities in the event of evacuation and transferring electronic appliances on top of table and higher part of the house to protect from flooding. Somehow the aggressive programs of the government have also motivated 38.36% of the respondents to prepare their family to safety when flooding occurs.

Meanwhile, the family’s safety was the main reason why respondents evacuated as reported by 47.6% of the respondents. The other reason was their experience in the past. Lesser number of respondents mentioned the reasons for evacuation such as to secure important items, advise of barangay authorities, neighbors are evacuating and sufficient knowledge on flood risks.

Table 10

Distribution of respondents by response of the households on flooding

Response	F	%
Time to Prepare		
When rain falls	147	48.2
When water levels are high	95	31.14
When the news says the weather is bad	89	29.18
When the community alarm rings	79	25.9
When authorities advise us to do so	31	10.16
When floodwater starts to enter the house	5	1.64
Total	446	

Response	F	%
Reasons for preparations on flooding		
Safety of family and relatives	159	52.13
Aggressive programs of barangay	117	38.36
Personal experience	84	27.54
Neighbors are also preparing	35	1.48
Knowledge of flood risks	26	8.52
LGU initiatives	16	5.25
Total	437	
Reasons for Evacuation		
Safety of family	201	56.94
Personal/past experiences	125	35.41
Self-decision	47	13.31
Secure important items	25	7.08
Advise of barangay authorities	22	6.23
Neighbors are evacuating	21	5.95
Not relevant to our experience	10	2.83
Advise/messages	7	1.98
Sufficient knowledge on flood risks	6	1.7
Total	464	

**Multiple response*

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 & Klijn, 2004). Moreover, Bubeck et al. (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 several studies. 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 et al. (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 11 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.

Risk perception and experiences in flooding towards reduction of vulnerability

Results of the focus group discussions 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).

Table 11

Distribution of respondents by risk perception of flooding (n=353)

Statements	SD	D	NDA	A	SA
It is a normal effect of rain.	5.7	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.	5.4	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

Legend: Strongly Disagree (SD); Disagree (D); Neither Disagree Nor Agree (NDA); Agree (A); Strongly Agree (SA)

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 reinforces risk perception which is contrary to Martin's (2003) and Martin et al.'s (2009) argument that actual experiences did not have significant impact on risk perception.

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 & Duval, 2006).

C. Davaoños' Awareness, Perception, and Assessment of the Risk Communication System

Questions referring to information channels, sources of the communication tools, and messages came from secondary and primary sources. Secondary data were sourced from CDRRMO reports while the primary data came from survey and key informant interviews. Specifically, survey respondents and key informants were asked of the barriers to the reception

of the messages and the communication tools and their perceived effectiveness.

Awareness of the Risk Communication System

Results of the study show that majority of the respondents are aware of the disaster risk reduction strategies to disseminate information about flooding. Table 12 summarizes the respondents' awareness of the barangay strategies to inform the residents about flooding. There were four major strategies identified by the respondents such as trainings and seminars, drills, early warning devices and use of communication tools. The use of communication tools refers to the exposure of the respondents on the tools utilized for disaster risk reduction strategies. It may be a previous or current existing communication tools such as posters, flyers, signage, among others.

Majority of the respondents are aware of the communication strategies on the communication system of Davao. More than 90% of the respondents were of the trainings and seminars followed by drills at 88.67% and use of communication tools at 80.45%. Among the early warning devices, alarm or siren was the most popular followed by use of megaphone. The house-to-house visit was also mentioned by 62.61%. Albeit still high, the respondents were least aware

of community assemblies as a risk reduction strategy with 55.81%.

Table 12

Distribution of respondents by awareness of the disaster risk reduction strategies (n=353)

Indicators	Awareness			
	Yes		No	
	F	%	F	%
Disaster Risk Reduction Strategies				
Trainings & Seminars	328	92.92	25	7.08
Drills	313	88.67	40	11.33
Use of Communication Tools	284	80.45	69	19.55
Early Warning Devices				
Alarm/Siren	296	83.85	57	16.15
Use of Megaphone	284	80.45	69	19.55
House to House	221	62.61	132	37.39
Use of Handheld Radios	183	51.84	170	48.16
Community Assemblies	197	55.81	156	44.19

In terms of the sources of information of risk messages on flooding, results show that respondents consider the BDRRMO as their major source of information on flooding, specifically, through trainings and seminars (25.5%), as well as distribution of communication tools (32.9%). Almost half of the respondents considered the use of siren or alarm (44.20%) as the major tool being used as early warning device. For the communication tools, they are mostly familiar with tools like posters, signage, brochures, radio communication and community meetings. Some are also aware of the following sources of information on flooding considered are word-of-

mouth and house-to-house information campaign by the zonal (purok) leaders (Table 13).

In addition, the respondents' familiarity on the communication tools as sources of information on flooding revealed that communication tools were also assessed, and majority said that they are aware of the distribution of the communication tools that relay information about the risks of flooding, how to prepare during disasters, the reminders for preparation and evacuation and location of evacuation centers in their areas.

Table 13

Sources of information on disaster risk reduction strategy

Indicators	Source of Information					
	Barangay DRRMO		City DRRMO		National/ NDRRMC	
	F	%	F	%	F	%
Disaster Risk Reduction Strategy						
Trainings & Seminars	120	36.59	152	46.34	56	17.07
Drills	265	84.66	48	15.44	0	0
Use of Communication Tools	97	34.18	88	30.99	99	34.86
Early Warning Devices						
Alarm/Siren	256	86.49	40	13.51	*	
Use of Megaphone	260	91.55	24	8.45	*	
House to House	215	97.29	6	2.71	*	
Use of Handheld Radios	163	89.07	20	10.93	*	
Community Assemblies	145	73.6	52	26.4	*	

Notes: Only the respondents who said yes in Table 12 as included in this table, hence the total of respondents per strategy varies.

**Not Applicable*

Table 14 summarizes the awareness of the communication tools. Ninety-five percent (95%) of the respondents reported to be familiar with the television or radio as the source of information on flooding followed by social media like text messages, Facebook (FB) or Twitter at 87.6%. Meanwhile, 83% were familiar with the brochures at the BDRRMC while 81% were aware with flyers or leaflets being distributed to the community as well as the posters that they see within the community (78.1%). Some are also familiar with the other sources of information on flooding such as word-of-mouth and house-to-house information campaign by the zonal (purok) leaders.

Table 14

Distribution of respondents by awareness of the communication tools as source of information on flooding

Tools	Awareness			
	Yes		No	
	F	%	F	%
Television or Radio	338	95.7	15	4.3
Social Media (Facebook, Twitter)	310	87.8	43	12.1
Brochures (with folds)	293	83	60	16.9
Flyers/leaflets	289	81.6	64	18.1
Posters	276	78.1	77	21.8
Billboards/Road signage	225	63.7	128	36.2
Seminars/Drills	177	50.1	176	49.8
Community meetings/Assemblies	155	43.9	198	56
Text messages	124	35.1	229	64.8
Radio Communication	107	30.3	246	69.6
Word of mouth	41	11.6	10	2.8

**Multiple response*

Assessment of risk communication strategies

Respondents were asked to assess the risk communication by rating the statements about communication strategies, effectiveness of communication tools, messages and efforts of the barangay using a Likert Scale with the following scale: 1- *Very Poor*, 2-*Poor*, 3-*Average/Fair*, 4-*Good* and 5-*Very Good*. Table 15 shows the summary of their ratings and assessment. Majority of the respondents or 58.6% have rated the communication strategies as *Very Good*; 32.9% *Good* and 8.5% with *Average* or *Fair* rating. None of the respondents gave *poor* and *very poor* ratings. Results of the survey as well as the responses of the FGD participants revealed that majority of the respondents from the flood vulnerable areas considered the efforts of the barangay and the strategies to be acceptable and are appreciated. Moreover, the participants also admitted during the focus group discussions, that oftentimes, they missed attending the seminars, drills and trainings due to conflicts with their work schedule. Some mentioned that there are instances that the zonal (purok) leaders only informed and invited selected residents, especially in cases when there are only limited slots available. However, they have lamented that some efforts cannot be implemented due to some constraints at the barangay level i.e., lack of manpower and lack of funds.

Table 15*Distribution of respondents by assessment of communication strategies*

Assessment Rating	F	%
Very Poor	0	0
Poor	0	0
Average/Fair	30	8.5
Good	116	32.9
Very Good	207	58.6
TOTAL	353	100

In terms of the content or type of risk messages that the communication strategies contain, majority of the respondents or 96.6% received guidelines for evacuation and information about the evacuation centers (93.8%). Only 43 or 12.2% observed information about disaster risks and 7.9% revealed information about disasters (Table 16).

Table 16*Distribution of respondents by the Types of Risk Messages*

Risk Messages	F	%
Guidelines for Evacuation	341	96.6
Information about Evacuation centers	331	93.8
Information about disaster risks	43	12.2
Information about disasters	28	7.9

**multiple response*

Effectiveness of the communication tools. Majority of the respondents consider that almost all the communication tools being provided and distributed to the barangays are effective. This assessment is attributed to the elements of visual designs

or its appearance using colors, photos and figures for tools like posters, flyers, signage and billboards; while accessibility for text messages and online media and understandability, relevance and reliability for face-to-face communication, specifically, during community meetings and seminars. Furthermore, television, radio and other mass media are both understandable and available to every household (Table 17).

This study echoes the role of risk perception and communication as an effective mitigation and preparation for disasters (Martin et al., 2009; Martin, 2003; Comfort, 1999; Kaspersen et al., 1988). Furthermore, Slovic (1987) emphasized that gaps in risk perception can be translated into deficiencies in disaster preparedness and adaptation strategies. Thus, this gap in communication can adversely affect local awareness of potential risk and the local response to a hazard like flooding. Similarly, it encourages a system-based (Reid, 2015) and multi-lateral approach (Okada & Matsuda, 2005) to empower the communities in developing their own risk communication strategies that will emphasize the multi-lateral knowledge and context-specific messages produced from the experiential learnings of the flooding incidents.

Table 17*Distribution of respondents by effectiveness of the communication tools (n=353)*

Tools	Assessment						Top Reason For Being Effective
	Effective		Ineffective		No Response		
	F	%	F	%	F	%	
Flyers/leaflets	319	90.4	34	9.6			Visual Design
Posters	321	90.9	32	9.1			Visual Design
Brochures (with folds)	321	90.9	32	9.1			Visual Design
Billboards/Road signage	325	90.9	28	7.9			Visual Design
Text messages	342	96.9	10	2.8	1	0.3	Accessibility
Social Media (FB, Twitter)	265	75.1	86	24.4	2	0.6	Accessibility
Videos	269	76.2	82	23.2	2	0.6	Accessibility
Community meetings or assemblies	347	98.3	5	1.4	1	0.3	Relevance & Relatability
Seminars/Drills	351	99.4	1	0.3	1	0.3	
Face-to-face communication	351	99.4	1	0.3	1	0.3	Understandability
Radio	352	99.7	1	0.3			
Communication	352	99.7	1	0.3			
TV or Radio	351	99.4	1	0.3	1	0.3	Understandability & Availability

The respondents have rated the communication tools as acceptable, however, some residents during the FGD expressed recommendations in terms of the management of the communication system as follows: (1) be more aggressive in giving trainings and seminars for all the residents and not to only selected participants; (2) uniformity and consistency in implementing barangay programs; (3) additional funds from the city or national agencies for disaster awareness and preparedness; (4) ensure that all areas, including in far-flung zones (puroks) are reached by the information campaigns and

materials; (5) ensure that all areas have siren/alarm; (6) all zonal (purok) leaders should be given hand held radios for faster and more coordinated communication especially during flooding incidences; (7) add more personnel so more residents will benefit from the barangay programs and projects on disaster concerns; (8) provide clear and well-defined guidelines on communication.

Use of communication messages and tools. In terms of the usage of the communication tools, Table 18 highlights the statements given to collect the respondents' assessment regarding the use of the communication tools and how they, as the receivers of the communication messages, perceive the contribution of these tools to their awareness and preparedness on flooding. The respondents highly regard that the risk of flooding is understandable for them and that they strongly agreed to the statements which reflect that the materials are understandable, communication transfer are clear especially during flooding incidences, the tools are context-specific in terms of awareness of the risk and other flood-related information. Moreover, they also agreed that the evacuation and rescue drills are imparted to them which reinforces their preparedness for flooding, specifically, the early warning devices alerted them during flooding and that it is timely disseminated so they can still prepare during flooding incidents. Similarly, respondents also acknowledged that the communication tools contain various

information as well as helped them understand the risks of flooding.

Table 18

Percentage distribution of respondents by assessment of the messages and tools (n=353)

Statements	SD	D	NDA	A	SA
There is various information that help me understand the risks of flooding	3.12	23.23	30.88	9.07	33.71
The risks of flooding are understandable for us	0	1.13	1.7	0.57	96.6
Evacuation and rescue drills during flooding are imparted to us.	4.82	17.85	15.86	5.67	55.81
There is no confusion when messages are relayed during flooding incidences in our area	1.7	5.1	20.11	4.25	68.84
Materials distributed to us are understandable.	1.98	5.1	18.98	4.25	69.69
Materials distributed are translated into our community's context.	1.98	5.38	18.7	3.97	69.97
Clear instructions are given for evacuation and relocation, when necessary.	1.13	7.65	8.5	1.98	80.74
There is an early warning device or system that alerts us during flooding.	2.27	6.52	24.08	6.8	60.34
Early warning system/device gives us appropriate time to prepare for flooding.	1.42	2.83	17.85	7.08	70.82

Legend: Strongly Disagree (SD); Disagree (D); Neither Disagree Nor Agree (NDA); Agree (A); Strongly Agree (SA)

On the other hand, these results affirm that the communication system of Davao city utilizes various channels of communication in communicating risk messages. Broadcast channels through TV and radio; mobile communication using text messages and electronic transmission via the social media; visual communication channels through posters and signage and written channels using posted memos or letters. Face-to-face communication channel is evidently the most utilized at the community levels, be it through formal and structured messages like seminars, drills or trainings or informal by word-of-mouth or simple conversation among the residents about the matter. The convergence of quantitative and qualitative results reinforced the description of the current risk communication system of Davao City. However, there is also the divergence in terms of the concerns raised to further improve the system which can be addressed by a community-based approach to risk reduction and management.

Assessment of the communication system at the barangay level

Source of information, strategies, and messages. As indicated in Table 13 the barangay officials serve as “filtering stations” when relaying information to the communities. These channels of information from the national to the municipality level follows the protocols as stipulated in the institutional framework of

each agency involved. Nonetheless, interoperability still operates enabling the communication flow as linear. Hence, this section explores the assessment of the respondents to the communication system from the barangay. There were 26 statements representing the source of information, use of tools, messages, and the over-all efforts of the barangay for awareness, preparedness and risk reduction. These areas of concern were also the themes derived from the follow-up focus group discussion (FGDs) conducted among the residents of the five barangays covered in this study. Questions used in the FGD were the open-ended questions to probe the assessment statements from the survey to further clarify and expound on the issues raised during the survey. Specifically, the focus of the discussion during the FGD was guided by the set of questions that serve as the themes, specifically, covering their attitude, awareness and assessments on the efforts of the barangay level officials as regards the heightening of the risk awareness and preparation on flooding in their areas.

There are five statements assessing the usefulness of the sources of information for amplification at the barangay level. Among the information, the respondents strongly agreed that instructions on evaluation and relocation are clear (80.74%) followed by the statement that purok leaders are relaying the communication messages on risk and awareness (75.07%) (Table 19). Meanwhile, more than half of the respondents

strongly agreed on the statement that the barangay captain is active in encouraging disaster and risk awareness campaigns (54.67%) and that the efforts and campaigns on flooding by the authorities are useful for us (52.69%). These findings showed that the barangay as source of information play an important role in the awareness, preparedness and information transfer within the barangay. However, the percentage of respondents who strongly agreed that concerns on flood risks are addressed appropriately by the barangay/purok at 37.39% indicates that the sources of information are not enough. Moreover, one-third of the respondents neither agree or disagree on this statement.

Table 19

Percentage distribution of respondents by assessment of the information received from the barangay (n=353)

Statements	SD	D	NDA	A	SA
My concerns on flood risks are addressed appropriately by the barangay/purok	2.83	15.3	33.14	11.3	37.39
The efforts and campaigns on flooding by the authorities are useful for us.	2.27	11.05	28.05	5.95	52.69
Our barangay captain is active in encouraging disaster and risk awareness campaigns	3.68	19.55	17.85	4.25	54.67
The purok leaders are relaying the communication messages on risk and awareness.	0.57	5.95	7.65	10.8	75.07
Clear instructions are given for evacuation and relocation, when necessary.	1.13	7.65	8.5	1.98	80.74

Legend: Strongly Disagree (SD); Disagree (D); Neither Disagree Nor Agree (NDA); Agree (A); Strongly Agree (SA)

Overall efforts of the barangay. In terms of the barangay efforts, statements were also provided to find out how the community assess the barangay efforts as regards risk communication on flooding (Table 20). Results of the study revealed that two-third of the respondents strongly agreed that barangay efforts are helpful in their preparation for flooding. However, for the rest of the statements, the percentage of respondents who strongly agreed was lower indicating less appreciation of the efforts of the barangay to communicate them the risk of flooding. Less than half of the respondents have strongly agreed that they were encouraged to participate on risk reduction and management program offered by the authorities while one-fourth have strongly agreed that they are always informed of trainings, seminars, and lectures on risk and awareness on flooding. Moreover, less than one fifth strongly agreed that the barangay has clear programs for disaster awareness. This pattern suggests that the efforts of the barangay officials are perceived to be less than messages and communication tools informing the residents of the risk.

Table 20*Percentage distribution of respondents by assessment of the barangay efforts (n=353)*

Statements	SD	D	NDA	A	SA
We are always informed of trainings, seminars and lectures on risk and awareness on flooding.	23.8	32.58	14.16	4.25	25.21
We are encouraged to participate on risk reduction and management programs offered by the authorities in our barangay.	3.69	15.34	26.42	5.11	49.43
The barangay has clear programs for disaster awareness.	10.3	35.04	30.48	5.7	18.52
The barangay has adequate programs for disaster mitigation.	9.39	33.7	33.98	7.18	15.75
Barangay efforts are helpful in our preparation for flooding.	1.7	6.8	24.36	4.82	62.32

While efforts are much appreciated, there are some barriers to communication which affected the reception of the efforts of the barangay. Table 21 shows that majority or 64% consider individual beliefs (i.e., flooding can be managed by themselves; confident of their safe location; hopeful that flooding will not affect them); while 32.7% considered experience with flooding and 27.8% considered personal knowledge about disasters are some factors that hinder reception of the risk messages. Some FGD participants claimed that their experience with flooding incidences provide

them with the best preparation for any eventuality. In addition, 44.8% considered stubbornness, lack of concern for safety, and belief that flooding is a common incidence as barriers to reception of communication efforts. The qualitative and quantitative results of the study converged, and this finding also conforms to the results of Cole and Fellows (2008) on the study of why some risk communication failed and consequently can translate into negative impacts of disaster to the households or communities.

Table 21

Distribution of respondents by perceived barriers to reception of the barangay efforts

Factors	F	%
Individual beliefs	226	64.02
Experience with flooding	114	32.29
Personal knowledge	98	27.76
Not interested	72	20.4
Poor dissemination	65	18.41
Low awareness	45	12.75
Unclear messages	13	3.68

**Multiple response*

Attitude of the respondents on the efforts of the barangay. Figures on Table 22 shows the attitude of the respondents towards the efforts of the barangay to communicate the risks of flooding. Despite their lower appreciation of the efforts of the BRRDMC as shown in Table 22, more than 90% of the participants have agreed that they are willing to join the future

activities on lectures and trainings on flooding and preparedness and drill exercises and are willing to evacuate if the authorities advise to do so.

Table 22

Percentage distribution of respondents by attitude toward the barangay efforts (n=353)

Statements	SD	D	NDA	A	SA
I am willing to join future lectures and trainings on flooding.	0.57	1.98	4.53	1.42	91.5
I will participate on preparedness and drill exercises.	0.28	1.42	3.98	1.42	92.9
I will be willing to evacuate if the authorities advise to do so.	0.28	1.42	2.27	1.42	94.62

Relationship of respondents' socio-demographics and risk related behavior

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., 2014; Fuchs et al., 2017).

Table 23 shows that there is no significant difference between the socio-demographic characteristics and the awareness of residents toward the risk of flooding. This means that regardless of age, household monthly income, number of years living in the current address, number of children aged

five years and younger, number of household members working, and number of household members attending school, does not affect their perception on the risk of flooding. Fuchs et al. (2017) found that among the demographic variables including gender, age, educational attainment, and income, only income was found to have a significant impact on individual risk awareness; where people with a higher income are more likely aware of the flood risk. Moreover, this finding is contrary to the findings of Bubeck et al. (2012) that social class and education are strongly correlated with higher levels of awareness and of flood risk and knowledge of how to respond to it.

Table 23

Residents' awareness of the risk of flooding by socio-demographic characteristics

Sociodemographic	Value	df	Asymp. Sig. (2-sided)
Age	6.095	9	0.73
Gross Monthly Household Income	14.504	9	0.106
Number of Years Living in current address	21.185	15	0.131
Number of Children aged 5 years and younger	21.909	15	0.11
Number of Senior citizens in the household	12.28	12	0.423
Number of household members earning salary	13.517	18	0.76
Number of household members attending school	29.284	21	0.107

Table 24, on the other hand, presents the relationship between socio-demographic characteristics of the residents and the barriers to reception of barangay efforts. There was a negative correlation between gross monthly household income and barriers to communication, which was statistically significant, $r_s = -.127, p = .017$. This indicates that as monthly household income increases, their level of perception to barriers decreases. Further, based on the results of the study, the number of household members attending school has negative correlation to barriers to communication and statistically significant, $r_s = -.124, p = .020$. This means that as the number of household members attending school increases, the perception on barriers decreases.

Table 24

Correlation between socio-demographic characteristics and barrier to reception of barangay efforts

Spearman's rho	Age Group	Income	Years of Residence	Number of children below 5	SenCit_HH	HH Me_Salary	HH Me_Sch	Res pBarrrs_Ndx
Correlation Coefficient	0.088	-.127*	0.086	-0.096	0.033	-0.084	-.124*	1
Sig. (2-tailed)	0.099	0.017	0.106	0.071	0.535	0.116	0.02	
N	353	353	353	353	353	353	353	353

***. Correlation is significant at the 0.01 level (2-tailed).*

**. Correlation is significant at the 0.05 level (2-tailed).*

Similarly, in terms of flood perception, results revealed that only the presence of children under five years of age in the household has significant negative correlation. Thus, suggests

that as the number of children under five in the household increases, the flood risk perception becomes weaker. This may be attributed to the fact that households with more number of children are prevented from joining activities that can enhance their perception of flood as a disaster and as a risk. They would rather attend to the needs of their children rather than spend time on activities outside the households. This idea was confirmed during the focus group discussions among mothers with children below five years of age. They would rather have their husbands or the barangay officials and just follow what instructions are given instead of themselves joining the activities on awareness and preparedness on flooding (Table 25).

Table 25

Correlation between socio-demographic characteristics and perception of flood risks

Spearman's rho	Age Group	Income	Years of Residence	Number of children below 5	SenCit_HH	HH Me_Salary	HH Me_Sch	Resp Barrs_Ndx
Correlation Coefficient	-.007	.102	-.019	-.138**	.034	.015	-.075	1.000
Sig. (2-tailed)	.903	.056	.717	.010	.527	.776	.165	
N	349	349	349	349	349	349	349	349

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

Summary

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.

The findings are in consonance to the studies on risk communication that highlights awareness and preparedness (Lindell & Perry, 2004) and the critical role of decision-making on disaster eventualities (Lindell & Perry, 2012). Specifically, flood risk communication studies have been documented highlighting the role of social networks (Haer et al., 2016), different strategies to improve flood risk communication (Haer et al., 2016; Lazrus et al., 2016; De Boer et al., 2014) as well as looking at different perspectives to assess the flood risk communication systems towards upgrading awareness and preparedness (Maidl & Buchecker, 2015; Demeritt & Nobert, 2014; Rollason et al., 2018; Feldman et al., 2016).

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 (Tselios & Tompkins, 2017; Comfort & Kapucu, 2006; Comfort, 2007; Christoplos et al., 2001).

In terms of the barangay efforts on risk reduction and management of risk messages and preparedness, participants agree that community meetings, seminars, lectures, drills and trainings conducted by the concerned agencies are useful in making people aware and encouraged them to prepare for any eventuality. Topics of these strategies include: emergency response like first aid and alert level parameters used for sirens and color coding of water levels, orientation and information on warning signals, preparations and guidelines for evacuation. However, they observed that since it was not done on a regular basis, due to conflict in schedules or lack of funding for such. Moreover, they have observed that efforts are being done to

mitigate flooding such as tree planting activities in collaboration with other agencies, schools and volunteer groups. Visible also are the warning signals like bridge markings, signage and posters as well as the use of text messages and radio communication to disseminate information to the community. In terms of the understandability of risk messages, the participants agree that simple and clear language is being used, posters or signage with technical texts are accompanied by easy reference visuals. Some areas, however, admit that they are not reached by these efforts and they rely on word-of-mouth and voluntary sharing of information among themselves.

Similarly, there has been a wide range of media being used for information dissemination which includes: face-to-face communication, mobile phones, radio communication, television and radio announcements, use of social media like Facebook. However, it was noted that the informal channels i.e. word of mouth and house to house strategies contribute greatly to the timeliness of the dissemination of information addressing the urgency of the attention calling among the flood vulnerable communities. These efforts, as well as their acceptance of the limitations of the barangay and the vulnerability of their areas have made the communities more informed about the risks and higher level of preparedness is encouraged and practiced.

As previous studies have been documented on risk perceptions (Christoplos et al., 2001; Terpstra et al., 2009; Martin et al., 2009), different risk communication strategies (Haer et al., 2016; Lazrus et al., 2016; De Boer et al., 2014; Sanchez & Sumaylo, 2015; Sanchez, 2014), modelling of risk studies (Cadag & Gaillard, 2012; Bradley et al., 2014; Lazrus et al., 2016; Lindell & Perry, 2012; Kasperson et al., 1988; Wisner et al., 2012) and evaluation of risk communication (Comfort & Kapucu, 2006; Leelawat et al., 2015; Mercado, 2016; Skinner & Rampersad, 2014), this particular study may provide additional literature as regards 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 current communication system of Davao City.

Summary, Conclusion and Recommendations

Summary

This study was conducted to address the gap in the literature that no studies have yet been found to specifically relate to risk communication management. Extensive literature and studies have been examined on the areas of risk communication and disaster risk management. While risk communication centers on the significance of communication to risk reduction and management at the different stages of the disaster cycle, and

disaster risk management focusses on the mitigation, response and recovery stages of the disaster cycle, no literature has been found to specifically reflect the integration of risk communication and disaster risk management. Thus, this study examined the role of risk communication in risk reduction and developed a community-based risk communication management framework relevant to the flood-prone communities.

Similarly, the research utilized Creswell's Convergent Parallel mixed method research, whereby the qualitative and quantitative approaches were utilized in the data collection and analysis guided by the integrated frameworks of the Social Amplification of Risk Framework (SARF) and the disaster risk management in the context of risk reduction and management using the case of Davao City's flood vulnerable communities.

Entry protocols were observed to gain the cooperation and participation of the involved agencies that were considered crucial in the key informant interviews, the survey and the focus group discussions. The KIIs were conducted from the heads of the PSSCC, the CDRRMO and the Liga-ABC --- the identified key agencies involved on disaster concerns within the months of August and September 2017. From these KIIs and from the review of secondary data through policy analysis and document reviews, the five barangays considered as the most vulnerable to flooding have been identified as: Matina

Pangi, Matina Crossing, Ma-a, Tigatto and Bucana. Similarly, the KIIs also provided the basic and necessary information necessary for the crafting of the survey questionnaire for the flood vulnerable communities. After the questionnaire was drafted, it was pre-tested to a flood vulnerable community for comprehensibility and appropriateness. The pre-test, however, revealed that some questions need refinement and that an enumerator-assisted survey is more appropriate to ensure that clarifications would be addressed immediately.

The questionnaire sought for the respondents' socio-demographic characteristics, experiences and practices to reduce vulnerabilities and their perception of the barangay's communication protocols and efforts, including their assessments of the communication system.

The survey was conducted among the 376 respondents, obtained from a multi-stage cluster sampling, from November 2017 to February 2018. However, only 353 were used in the data analysis due to incompleteness of many questions.

Focus group discussions (FGDs) were also conducted in two sets per barangay: Set A comprised of the implementers of the risk communication which included the barangay captains, purok leaders and members of the BDRRMCs to cover discussions on the management, strategies, tools and messages used for flood risk awareness and preparedness. Meanwhile, Set B included the residents of the flood vulnerable

communities to discuss the open-ended questions of the survey instrument for clarifications and gain additional insights as regards to their suggestions and expectations for a community-based risk communication management system.

Data were analyzed using frequency distribution, ranking, graphs, and correlational analyses using R statistical software and Microsoft Excel. Specifically, the Spearman's Rank Order Correlation was used in determining the factors related to the comprehensive implementation of the communication system as regards to the utilization of the communication channels, tools, and messages.

The premise of this study is that flood risk as a hazard to flood vulnerable communities interact with the psychological, social, institutional, and cultural processes in ways that may amplify or attenuate the community's responses to the risk or risk event. Amplification occurs at two stages: in the transfer of information about the risk, and in the response mechanisms of society. The amplified risk leads to behavioral responses, which, in turn, results to secondary impacts.

The results of the study derived from the qualitative and quantitative approaches revealed the following:

The risk communication system of Davao City is compliant to the institutional framework as provided for in the RA 10121 and utilized a structural flow of "top-down" approach from national level to the barangay level, priority

given among the identified 63 flood-prone communities, results show; however, that not all the barangays have well-defined information structure toward its residents. It was a downward communication flow at the level of the municipality, utilizing the city agencies as the lead implementers, namely, PSSCC, DRRMO/911 and ABC Liga. Results of this study also show that the risk communication system adopts a system approach and there is interoperability among agencies in implementing disaster management which follows the prescribed protocols and processes as stated in the NDRRMP. The risk communication utilizes various communication tools from written, visual, electronic, face-to-face communication to sophisticated maps and GIS to make people aware, prepare and respond to disasters for awareness, preparation and responses. However, respondents expressed that this set-up is not replicated at the level of the communities and some suggestions emanated from the communities include a more defined and structured management of risk communication and utilize extensive use of communication tools to reach all the affected households and work towards a more aggressive and comprehensive awareness and preparedness strategies to reduce the risks. Moreover, there is a need to encourage participation and involvement of the community to address specific concerns that may be disregarded by the top-down approach.

Flooding has been experienced for the past 20 years in the areas and the past direct and indirect experience have evoked preparedness among individuals and their households reflecting that the flood vulnerable communities are aware of the risks and its consequences. The vulnerability of these flood vulnerable communities is associated with their socio-demographic characteristics which are commonly referred to as social vulnerability indicators on disaster studies. The collected social, demographic and economic data included age, gender, civil status, education level occupation; religious affiliation of the respondents and household information which covered gross monthly income, number of household members engaged in economic activities and attending school. Other information collected included type of house occupied, nature of house ownership, and type of house materials. There were also questions referring to experiences and response to flooding as well as practices to reduce vulnerability. Sources of information about flooding and communication tools were asked during the focus group discussion which were participated by selected households and key informants and from secondary sources. Results of the study revealed that the respondents have confirmed that their experiences have significantly improved their risk perception and awareness level leading towards a more pro-active attitude and response toward flooding. The flood vulnerable communities'

perception of risks is directly associated with the perceived causes of flooding. Moreover, although aware of the risks, residents cannot relocate even if they are willing due to the expenses to be incurred to secure another residence elsewhere.

Moreover, the findings on the community's perception and assessment of the risk communication systems at the barangay level showed that responses to flooding practiced by the residents are working for their self-monitoring and preservation at times of flooding incidences, however, these are not integrated as part of the community's risk reduction practices. Moreover, having been subjected to the previous flooding experiences, they no longer see the need to rely on formal risk communication messages, rather, they resort to adaptive measures to respond to flooding occurrences that they seem to be appropriate. The respondents expressed that there is a need to improve the communication system and management specifically at the community level and suggested that participatory approaches be utilized in the awareness and preparedness.

In terms of the communication strategies, it was found that there is a high rate of satisfaction in terms of the barangay efforts, however, they still look forward to being acknowledged as partners to accommodate their inputs and participation. Moreover, the FGDs revealed that some conflicts between barangay officials and purok leaders interfere

with the management of communication as well as the disaster response itself.

Results of the correlation analysis on the community's reception and assessment of the risk communication system revealed that there is no significant relationship between the transfer of risk communication signals and how communities assess the efforts of the concerned agencies, however, their experiences and perception of flood risks influence these assessments. There was, however, a negative correlation between the gross monthly household income and perception to barriers. This indicates that as monthly household income increases, their perception of barriers to barangay efforts decreases. Similarly, the number of household members attending school has negative correlation to perception of barriers to barangay efforts. This means as a greater number of household members attends school, their perception of barriers to barangay efforts decreases. On the relationship between socio-demographic factors and flood-risk perception, the study revealed that the presence of children below five years has been found to have significant relation with the risk perception. As number of children below five years increases in the household, the flood risk perception becomes weaker. This may be attributed to the idea that presence of children below five years hinders the household in active participation on awareness and preparedness activities. These findings have

been consistent with the results of the focus group discussions (FGDs) among the residents of the flood vulnerable communities. Similarly, one of the major suggestions for the management of risk messages at the community level was to develop a communication management plan at the level of the communities. They sought for a defined structure and process of communication within the community where identified key persons, aside from barangay captain and purok leaders, should be assigned per area for faster and easier sharing of communication messages.

The findings specified above are in consonance to the studies on risk communication that highlighted awareness and preparedness (Lindell & Perry, 2004) and the critical role of decision-making on disaster eventualities (Lindell & Perry, 2012). This also conforms to the flood risk communication studies which showed that other factors affect reception to risk communication efforts, specifically, role of social networks (Haer et al., 2016); various tools and strategies to improve flood risk communication (Haer et al., 2016; Lazrus et al., 2016; De Boer et al., 2014), as well as looking at different perspectives to assess the flood risk communication systems towards upgrading awareness and preparedness (Maidl & Buchecker, 2015; Demeritt & Nobert, 2014; Rollason et al., 2018 and Feldman et al., 2016).

Using the findings from the qualitative and quantitative data, a community-based flood risk communication management framework is proposed which could help integrate the significant contribution that the residents may provide based on their own experiences and adaptive strategies in flooding. Further, it could provide significant inputs to the policy recommendation for a localized and participatory approach on risk reduction strategies.

It is, however, noted that the results cannot be generalized because the study only covered the top five flood vulnerable communities from the identified 63 flood-prone communities in the Davao City hazard map. However, specific results in the context of the five barangays studied may be relevant to other flood vulnerable communities of similar context like low lying communities situated near the rivers. Similarly, since the study is aimed towards the risk communication management and systems involved, no full evaluation was done specifically to present a comprehensive communication audit of materials used for risk communication.

Conclusion

Theory and Knowledge Generation

The integration of the risk communication and disaster risk management which may be a first attempt in research

utilization has been useful in the conduct of this study. The elements of the theories of SARF and the disaster risk management cycle have reinforced the examination of the risk reduction strategies in the context of the flood vulnerable communities of Davao city. The study among the flood vulnerable communities using the social amplification risk framework and disaster risk management provided effective tools in examining the communities' assessment of communication systems. It also captured the underlying issues that affected vulnerability and resiliency towards flooding. It also described the current institutional dynamics as well as the capacities of the communities to address this disaster.

Methodology

In terms of the use of methodology, Creswell's Convergent Parallel mixed method design has proven to be effective in the reinforcement and complementation of the quantitative with the qualitative results. The merging of the analysis of the results using the quantitative and qualitative data revealed the convergence, showing the complementary and reinforcement. However, there was also the divergence between the quantitative and qualitative findings in relation to the awareness of the area as flood risk and the willingness to relocate. While the quantitative results show that there was a positive response on both areas during the survey, the results

of the FGD contradicted this idea when participants disclosed that relocation is not possible due to the high economic cost. This divergence could be attributed to the fact that the survey questionnaire only allowed a yes or no answer and did not allow further discussion. On the other hand, the FGD encouraged them to elaborate and discuss the issue further.

Locale of the Study. Davao City is naturally flood prone area manifested by its physical characteristics. This is further magnified by the high urban population density and human settlements found along the river banks or nearby river tributaries. 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 et al., 2004; Comfort, 2007). In addition, there is a need to enhance relationships, social ties and inter-organizational coordination to sustain the strong social capital among the concerned communities with the varied organizations (Comfort & Kapucu, 2006; Australian Red Cross Report, 2013; Oh et al., 2014). Moreover, flood risk awareness and preparedness can be further improved through an integrated flood risk communication management approach (Thieken et. al., 2016) to emphasize on the following areas: (1) effective risk communication and management leads to appropriate

precautionary actions; (2) community participation and inputs of adaptive measures and precautionary ideas can help improve flood risk information campaign; (3) flood hazard information, precautionary measures and coping possibilities should be linked more effectively to provide context-specific approaches toward risk communication management.

The following conclusions can be derived from the results:

The amplification of the messages was not clearly seen in this study. The agencies as the “filtering stations” did not transform the messages for attenuation, rather, cascaded the information downward without any alteration or modification. FGDs also revealed that some problems in the communication system was due to the conflicts between and among the barangay officials and the purok leaders. There is a need to replicate the interoperability of key players at the level of the communities.

The flooding experiences of the flood vulnerable communities have provided the residents the adaptive measures to respond to flooding occurrences that they seem fit to be appropriate. Some of these strategies included the following preparations whenever there is threat of flooding: (1) food storage in case they are stranded at the second floor of their house; (2) packed necessities in the event of evacuation; (3) elevating electronic appliances to protect from flooding;

and, (4) evacuation first of the children and senior citizens to safer areas even prior to evacuation orders by the LGUs. Moreover, the male members of the household in most cases of evacuation decided to stay for the security and protection of their properties and belongings. The respondents, however, expressed that a more sustained risk communication may help improve the risk reduction strategies at the community level for a more coordinated response to flooding occurrences.

The lack of a standardized or structured management of both risk communication and disaster response translates into poor communication interaction during and after a flooding incident happens. This is observed during the 2011 flashflood incident which resulted to 29 fatalities and destruction of properties in the Matina area. Thus, a more defined and clear flood risk communication management may help define the specific protocols that can improve the coordination and flooding responses at the community level.

A proposed community-based flood risk communication management framework may address the gaps and standardize localized approach to specific contexts of the flood vulnerable communities. It may help identify the key persons that can help plan and strategize appropriate communication messages and tools in collaboration with the residents, coordinate and manage the preparedness and response strategies to reduce risk and ensure that management, coordination and interoperability

is observed at the community level. The framework can also address the limitation of SARF which covers only the risk-centered approach to amplification and has been observed as a linear approach to the communication of flood risks.

Recommendations

The study of flooding in Davao City should not only be approached within the confines of Davao City geographical boundaries as it has a myriad of dynamics, factors in governances 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 (Christoplos et al., 2001). Moreover, it is also best to explore the ecosystem based and community-based adaptation measures may be explored to engage most vulnerable communities in activities that can mitigate the ill effects of flooding in the future such as “community-led drainage clean-up”, “neighbors-policing-neighbors” for good practices like planting of bamboos along river banks to avoid further erosion, etc. Incentives for best practices may be designed to encourage further and model communities. Essentially,

community-based adaptation (CBA) that is a community-led process, based on communities' priorities, needs, knowledge and capacities on managing disaster such as flooding (Reid, 2015).

A CBA approach would empower them and instill the principle of shared growth and accountabilities in flood risk management, reduction/mitigation of flood risks, among others. This is another avenue to develop and further enhance social capital among stakeholders and the general community. But emphasis on areas to work on should be at the forefront of discussion and decision among key players, e.g., local government units, development-oriented groups, etc.

In terms of governance, consolidation of existing policies, regulations, and updating of these essential governance-related documents will always be relevant as communities, cities, and governance aspect is always evolving and transitioning to better respond to various needs of clients. This would include harmonization of efforts, plans, and programs targeted to address flood risks in the study area. It is critical that information, education campaign be upscale, and to pursue aggressively via flash flood specific materials to put emphasis on the risks anybody is exposed to, and how they can contribute to minimize if not avoid disruption in their daily lives for flooding occurrences in the future. However, long term perspective must be central to any development initiatives

as far planning and development interventions to mitigate if not avoid flooding in Davao City, particularly in the areas of this study.

Knowledge generation and Theoretical Implications

(1) Flood Risk Amplification Communication Theory is proposed as a modification in the Social Amplification of Risk Framework, utilizing a community-based, localized and participatory approach. This will address the limitation of the current SARF as a linear approach towards a shift from a risk-oriented to people-centered focus of amplification. The community becomes the main source of amplification, utilizing flood-risk behavior as part of the message development with the integration of all the stakeholders into a strategic risk communication approach towards flood risk reduction.

(2) Since this study has the novelty to use risk communication management, which was considered gap in the examined literature, a similar approach can be done to add literature to this area of knowledge.

Practical

For the implementing agencies, the results of the study may be useful in crafting a well-defined risk communication plan for the flood-vulnerable communities capitalizing on the documented experiences, challenges, responses and self-

imposed strategies for preparedness. Specifically, the following can be done at the level of the barangays:

(3) Re-activate and create a clear organizational set-up of the DRRM that will give defined tasks and functions as well as identify target persons with emergency contact information for proper guidance of the residents.

(4) Craft an annual calendar of activities for awareness and preparedness on flooding.

(5) Develop a context-specific risk communication plan to target specific audiences with the most appropriate communication tools to relay the risk messages on flooding.

(6) Document all the DRRM plans, projects and strategies as well as monitoring and assessments of these activities to provide proper guidance on the achievement of goals and identification of the effective DRR strategies for the community. These materials should be open for public awareness for transparency.

(7) Initiate a multi-sectoral committee specifically on DRRM, consisting representatives from the different sectors such as youth, women, church, and other groups. Through this, dialogue and open communication can be encouraged to address all concerns from different sectors and more inputs can be generated to work towards a context-based risk communication system.

(8) Engage the community on trainings, seminars and lectures to encourage sharing of experiences and best practices on DRR strategies and preparedness on flooding.

(9) Conduct flood drills that would involve all the residents especially those on the highly vulnerable areas.

(10) Create or strengthen MOAs with various agencies like NGOs and private companies to address the barangay's limitations on funding and manpower in implementing DRRM initiatives and projects.

Policy

In terms of policy recommendation, an institutionalization of a “localized” risk communication management is proposed as follows:

(11) Integrate disaster communication protocols from the community level for integration with the plans of the different agencies involved, specifically, involve all the 63 high risk barangays of Davao City in creating their own DRRM adaptation strategies.

(12) Design a manual of protocols for guidance of appropriate responses and actions, including the IRR for developing community-based risk communication plan and strategies.

(13) Specify a period of implementation and corresponding evaluation after an appropriate timeframe,

including the monitoring of the conduct of trainings and seminars.

Future Studies

(14) Document experiences and further analyze the risk perception and awareness on disaster among the other flood vulnerable communities that may help build context-specific IRRs at barangay levels from the national level of the NDRRMP.

(15) Risk communication and management studies should be further explored at the community levels for a more comprehensive baseline data that can enrich and enhance DRR strategies and management policies.

(16) Risk perception studies can help provide a more specific and focused messages anchored on local context and culture that can help generate support on building resilience and adaptive capacity. Moreover, minimize fear and empower communities to act according to their specific needs and situation.

(17) Utilize the proposed Flood Risk Amplification Communication Theory to test the modification of SARF.

CHAPTER 7

Flood-risk Amplification Communication Theory: Towards a Modified Social Amplification of Risk Framework

The Social Amplification of Risk Framework (SARF) of Kaspersen et al. (1988) is primarily uni-directional or linear as it reflects only the role of the integration of risk assessment with the psychological, sociological and cultural perspectives of risk perception and risk related behavior. However, the amplification only involves the level of the source of message and considered the receivers as end-user of the risk messages. It therefore lacks the elements of a community based and networked integrated elements necessary for risk event. Figure 27 highlights the following modifications in the Social Amplification of Risk Framework (SARF): (1) the community becomes the central focus of the amplification then extends its reach to the informal and formal networks; (2) strategic risk

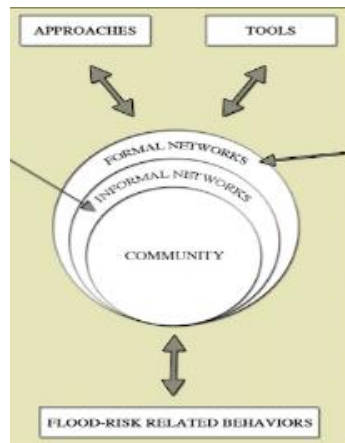
communication triad is highlighted to cover the element of flood risk related behavior which includes the lessons and responses in flooding experiences as major factor in message development, utilizing the approaches and tools to strategize the flood-risk communication towards the target audience.

Despite the “ripple-effect” at the social amplification stations, the individual is not considered as a major element in the social amplification of risk framework which is contrary to most researches on risk amplification which focused on the social components of the framework. It does not consider that the individual can provide significant contribution for amplification in the process. The respondents’ direct experiences on flood risks increases memorability and imaginability of the hazard, as well as provide feedback on the nature, extent and manageability of the hazard, creating better perspective and enhanced capability to avoid the risk. Thus, it can serve as a risk amplifier as well as act to attenuate risk.

Figure 27

Flood-Risk Amplification

Communication Theory (FRACT)



The proposed Flood-Risk Amplification Communication Theory highlights the modification in amplification of SARF (Figure 27) which can be a guide to address the following concerns found to be absent in the current communication system of Davao City: the lack of communication protocols at the barangay level; the insufficiency of communication approaches; failure to involve all the affected residents; and the lack of coordination and management on communicating flood risk. The respondents expressed that the current set-up of risk communication can still be improved in terms of its strategies and management since more people are living in flood-prone areas and risk of flooding increases due to climate change and urbanization, hence, it is increasingly important to communicate flood risk to the public (Haer et al., 2016). Nyondo in 2006 (as cited in Skinner & Rampersad, 2014) also emphasized that if the process of communication is difficult in our ordinary and daily lives, it is far more so in times of disaster. 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.

Ensuring that risk reduction and management at the community levels is achieved for the flood vulnerable

communities of Davao City, the risk communication management approach should consider the integration of flood risk communication integrated with the disaster management cycle. The approach used in designing the proposed framework has the following objectives:

- (1) Empower the communities to work towards self-reliance specifically on flooding.
- (2) Create interoperability at the levels of the community.
- (3) Build community capacity and preparedness through a more sustained risk communication management.
- (4) Engage community participation and develop strategies that are context-specific.
- (5) Deliver programs that can address flood risk communication as well as disaster management in an integrated and complementary approach.

Moreover, the planning and crafting of the details of the program would entail the adoption of the following reminders:

- Flood risk communication planning cycle should be present in every stage of the disaster management cycle.
- The objectives of the communication plan should be dependent on the context.

- To ensure effective implementation of the flood risk communication, it is imperative that human and material resources are sufficient and adequate.
- Resources and activities are dependent on the following functional areas: research, monitoring and evaluation, policy matters, media placement, training and capacity building and community-based education and development activities.

The **Flood-Risk Amplification Communication Theory** integrates the gaps both in the literature and the needs of the flood vulnerable communities in the context of flood risk reduction concerns. The theory is proposed based on the following areas of concern:

(1) Underlying principles

Institutional Mechanism. This includes the policies or legal basis of the agencies task/function, the communication protocols or procedures, and the flow of communication and the expectations of both the organization and the community. Institutional structures and mechanisms for inclusive disaster risk governance can be achieved through participatory processes that can lead to a participatory and collaborative policy making which involves the government institutions, stakeholders and the affected communities.

Alternative Policy Recommendations. Three areas for policy recommendation for a “localized” DRR communication

interventions include: (a) creation of the working group to do further research and craft a synthesized reception analysis of the current risk communication system among the 63 flood vulnerable communities; (b) crafting of the manual of protocols for a quick reference guide for all the stakeholders; and, (c) include in the communication plan the period of implementation and the appropriate evaluation and monitoring of the strategies.

(2) Guiding parameters

(a) Balanced and coordinated strategies for reducing risk and coping with impacts of flooding should emanate from the community levels towards the different agencies involved, involving a simultaneous approach of “top-down”, “bottom-up” as well as horizontal communication flow to encourage a transactional communication process among all the involved sectors.

(b) Transboundary and cross-sectional cooperation should be encouraged. Risk reduction and disaster response must be coordinated among various stakeholders and concerns must be systematically identified and anchored in flood-risk management plans that clearly defines the context-specific concerns of the communities.

(c) A localized and participatory approach must encourage the involvement of the communities, in particular, encourage risk dialogue to enable local interests, experiences

and knowledge to be integrated into locally adapted risk management strategies.

(d) Formulation of binding regulations or policies for incorporating the community concerns in the planning process to enhance coping mechanisms and capacities.

(3) Elements of the proposed theory

The following elements will be utilized in the operationalization of the Flood-Risk Amplification Communication Theory:

(a) strategic risk communication aimed towards flood risk reduction

(b) stakeholders which include the community, the formal and informal social networks as major actors of the risk communication process: informal social networks include family-relatives and neighbors; while the formal social networks involves the different agencies including the disaster coordinating unit, the mass media; emergency team units; social work unit; health unit and NGOs

(c) flood-risk related behavior reflecting the lessons from the experiences and practices of the communities that can be shared among the stakeholders.

(d) approaches in the strategic risk communication which include the strategies of information flow, multi-lateral knowledge development, interoperability of mechanisms

highlighting the integration of communication, control and coordination.

(e) the communication tools which highlights a study of appropriateness of specific tools for specific target audience

(f) flood-risk messages to account for the significant messages that would address the specific contexts and needs of the informal as well as the formal social networks.

The proposed theory is aimed towards community safety in the events of flooding which encourages community self-reliance, long-term community-based programs that is context-specific. This theory recognizes that people have varied perceptions on risk and adaptive measures and encourages prior assessment of existing knowledge and practices as inputs to the crafting of the flood risk communication management approach.

CHAPTER 8

Community-based Flood-risk Communication Management Framework and theory towards Risk Reduction

Towards a more integrated flood risk communication management approach

Utilizing the context of the Davao City's flood vulnerable communities (Basa, 2017; Boquiren, 2017; Bustillo, 2017; Carillo, 2015; DRRMO reports, n.d.; Figureoa, 2019; Revita, 2018), the approach to its risk communication must consider the integration of flood risk communication with the disaster management cycle. This approach reinforces various studies which revealed that flood risk management is greatly affected by different factors (Kreibich et al. 2005; Kreibich et al., 2011b) and the responses to flooding incidences are affected by changes in preparedness practices (Kreibich et al., 2011a; Helsloot & Ruitenber, 2004; Howard et al., 2017; Kerstholt et

al., 2017), the flood vulnerable communities' adaptation practices to flooding are developed through time (Kreibich et al., 2017; Kreibich et al., 2007; Kreibich & Thielen, 2009). Moreover, Thielen (2016) emphasized that: (1) flood risk awareness leads to precautionary actions if effective risk communication and management is implemented; (2) flood hazard information, precautionary measures and coping possibilities should be linked more effectively to provide a more context-specific approach; (3) timely and reliable warnings especially to low-lying areas should be given in the event of rainfall in the higher areas; and, (4) training of communities to ensure alertness and precision of flood responses should be encouraged.

In the current set-up of Davao City, the risk communication system is greatly influenced by the existing policies and frameworks in compliance to the RA 10121. Despite the fact that after the 2011 flashflood, the flooding incidents of 2013, 2017 and 2018 revealed that communities and agencies involved are better prepared and interoperability among agencies have been observed (Boquiren, 2017), the residents of the flood vulnerable communities expressed that they would be more confident and secured if they can participate in the planning and operationalization of risk reduction strategies. Thus, there seems to be a gap in the implementation at the community level in terms of the lack of

a “community-based” approach to empower the communities to practice “self-protection” and “independent coping strategies” (Thieken et al., 2016; Tselios & Tompkins, 2017). Moreover, survey respondents and FGD participants have expressed that they are willing to participate and provide inputs in the crafting of appropriate risk reduction strategies that will help them in improving their awareness, preparation and response to flooding incidences in their communities.

To address this, the following insights were derived from the results of the study as the guiding parameters in the proposed framework:

(1) Balanced and coordinated strategies for reducing risk and coping with impacts of flooding should emanate from the community levels towards the different agencies involved, involving a simultaneous approach of “top-down”, “bottom-up” as well as horizontal communication flow to encourage a transactional communication process among all the involved sectors.

(2) Transboundary and cross-sectional cooperation should be encouraged. Risk reduction and disaster response must be coordinated among various stakeholders and concerns must be systematically identified and anchored in flood-risk management plans that clearly defines the context-specific concerns of the communities.

(3) A localized and participatory approach must encourage the involvement of the communities, in particular, encourage risk dialogue to enable local interests, experiences and knowledge to be integrated into locally adapted risk management strategies.

(4) Formulation of binding regulations or policies for incorporating the community concerns in the planning process to enhance coping mechanisms and capacities.

The findings of this study are consistent with findings from other disaster studies which emphasized the significant role of risk communication (Comfort et al., 2007; Mercado, 2016; Pidgeon et al., 2003; Kasperson et al., 1988; Terpstra et al., 2009; Lindell & Perry, 2012; Duckett & Busby, 2013). Disaster risk reduction (DRR) strategies in this context can be enhanced through proper knowledge development and dissemination of flood-risk communication from the different stakeholders that would eventually implement the strategies presented therein. Consequently, focusing on how the communication tools and messages can be made more relevant to the target recipients. Effective communicative processes and practices are widely regarded as core to disaster and risk management (Howard et al., 2017; Bradley & Clarke, 2014; Clerveaux et al., 2009; Cole & Fellows, 2008), however, the need for coordination and integration play a significant role (Comfort & Kapucu, 2006; Kubicek et al., 2011). Thus, a

community-based intervention is necessary whereby community perception, attitudes and behavior towards flooding as a result of their past experiences should be documented and highlighted as the major outcome from interaction between legislation, organizational policies and practice, collaborative and participatory actions that can be transformed into a community norm towards flooding incidences.

As various studies in the literature presented that coupled systems of humans and nature are complex in terms of how they anticipate and respond to natural disasters, the complexities present great uncertainties for many facets of society. The capacity to deal with the types of uncertainty and surprises will require novel approaches, creative combinations of strategies, and the ability to adapt in a changing environment. Accelerating learning and supporting novel approaches that limit vulnerability and expand our understanding of the occurrence and impacts of natural disasters seem to be critical components of building community resilience. Hence, the risk communication approach must be tailored-fit according to the context of the specific community and encourage the sharing of experiences and adaptive measures across the flood-vulnerable communities so as to document and select appropriately the messages and tools for the communication.

Results of the study revealed that Davao City's flood vulnerable communities are resilient since the communities have the capacity to "bounce forward" following an adverse event such as a flooding disaster or crisis (Houston, 2018; Maxey et al., 2013; Rufat et al., 2015). This is proven by the residents' decision to stay in the flood vulnerable areas despite the impact of flooding occurrences that they have experienced over the years. They have resorted to using adaptive strategies instead. However, majority of the respondents are hopeful that they can improve their strategies if they are properly guided and educated about flooding, the risks involved and the appropriate preparation steps that they need to know. Norris et al. (2007) states that as different models of community resilience have emphasized various adaptive capacities that contribute to collective recovery, capacities of information and communication, community competence and social capital as crucial to community resilience (Australian Red Cross, 2013; Daniel & Meyer, 2015). Ultimately, due to the collective nature of community resilience, communication is a core concept that cuts across other components or elements of the complex adaptive systems (Comfort et al. 1999; Dickens, 2012). O'Neill (2004) argues that from a risk communication perspective, both individual and community concerns must be recognized as components of community resilience. As such, it also recognizes that communities and organizations operate as

networks and groups rather than as discrete individuals. Thus, instead of focusing only on the implementation of the disaster risk management through the agencies involved, a risk communication on a localized and participatory approach is being envisioned by the flood vulnerable communities. Results also revealed that they have expressed the willingness to cooperate and participate which gives them the ownership and accountability for their own safety against flooding occurrences.

The RP Gazette (2012) discussed that the Philippine Disaster Reduction and Management Act (RA 10121) provides a comprehensive, all-hazard, multi-sectoral, inter-agency and community-based approach to disaster risk management through a framework that promotes the development of capacities in disaster management at the individual, organizational and institutional levels. It also recognizes local risk patterns and trends and decentralization of resources and responsibilities and thus encourages the participation of NGOs, private sectors, community-based organizations and community members in disaster management. The barangays involved in this study have admitted that they are still dependent on the city level DRRMO due to its lack of manpower and insufficiency of funds. Hence, there is a need to review the community level implementation of the DRRM and encourage a more proactive approach by institutionalizing

a uniform attention on this matter across the flood vulnerable communities. To address the centrality of risk communication towards a more context-specific and community-based approach, the following should be the underlying principles of the proposed framework:

Institutional Mechanisms. This includes the policies or legal basis of the agencies task/function, the communication protocols or procedures, and the flow of communication and the expectations of both the organization and the community. Institutional structures and mechanisms for inclusive disaster risk governance can be achieved through participatory processes that can lead to a participatory and collaborative policy making which involves the government institutions, stakeholders and the affected communities.

Thus, in relation to the national policies, the local government units, specifically, the barangays can 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 on disaster-related communication intervention tools. Capturing a paradigm shift on disseminating polices from a top-down to a localized participatory approach.

Based on the results of this study, Davao City has been compliant and very active on DRR and CC related programs, however, they admit that there is still no City Ordinance that captures the de-centralization of communication tools that will encourage the barangays to “localize” the materials as distributed by the national and LGU levels. There are some barangays that initiated this approach, but, since it is not mandatory, majority of the barangays utilize the materials from the national level. Hence, capturing this initiative into a City Ordinance will be a point of consideration for a policy alternative. Thus, empowering the communities and ensuring the sustainability of the knowledge transfer. A community-based approach will be more appreciated by the communities since it can now be a contextual approach, catering to their specific concerns and interests. Continued development in lowlands and the increase in population in the next years is expected to also increase in disaster-related damages. Thus, there is a need to shift from the response-oriented to a proactive DRR interventions at the local levels. Modifications from a decentralized to a localized DRR communication tools can be one strategy that would help increase the effectivity of the awareness, mitigation and preparedness at the level of the local communities.

The case of flooding in Davao City challenges the national policies on DRR and CCA and reflects that it should

not only be approached within the confines of Davao City geographical boundaries. It is 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. 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 as it is ‘a community-led process, based on communities’ priorities, needs, knowledge and capacities, which should empower people to plan for and cope with the impacts of climate change’ (Reid, 2015). 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.

Alternative Policy Recommendations. Three major areas for policy recommendation in line with the institutionalization of a “localized” DRR communication intervention may include the following:

- 1) Create a working group that will integrate disaster communication protocols from the community-level for integration with the plans of the different agencies involved,

emphasizing the following concerns: inclusion of the 63 flood vulnerable communities; examine the risk perception and local knowledge and practices in risk reduction and evaluate the community's perception and reception of the current risk communication system as well as their assessment of the LGUs efforts on risk reduction.

2) Craft a Manual of Protocols for guidance of appropriate responses and actions from the different agencies, highlighting the significant role of the institutional frameworks, interoperability mechanisms vis-à-vis the integration of the community's varied contexts on disaster incidence, as follows: identify the specific agencies and provide plans for a community-based and participatory communication plan and present to stakeholders for comments and inputs from both the communities and the agencies.

3) Specify a period of implementation and the corresponding evaluation after an appropriate timeframe in the conduct of reception analysis, development of "localized" materials and implementation of community-based trainings and seminars.

Creating a community-based disaster reduction approaches is of significance at times where local knowledge, experience, communication networks and social capital are needed to capitalize on reduction of vulnerability and ensure

collective response to disasters. The effectiveness of “localized” and participatory risk communication is closely associated with internal factors that affect an individual’s capacity to access and use information, with external factors related to entitlement properties of communities or individuals at risk and their ability to communicate effectively within a socio-political context (Mayhura, ND). Thus, a City Ordinance to this effect will benefit a total of 182 barangays of Davao City once approved and adopted.

Within the above broader framework, local authorities can play a pivotal role in facilitating community action through the following interventions which are similar to Kafle and Murshed (2006):

- Establish policies as per the local needs
- Identify and prioritize most vulnerable communities
- Conduct local and community level risk assessment
- Document local coping mechanisms and expertise
- Development of local disaster preparedness plans
- Facilitation of community level preparedness planning
- Establish local and community level Early Warning Systems (EWS)
- Capacity enhancement of community volunteers and groups; e.g. training on search and rescue, extrication

of the trapped from buildings, first aid, firefighting, swimming, evacuation drills and risk assessment, etc.

- Regular upgrading of disaster preparedness and mitigation plan
- Providing resources to community volunteers and groups; e.g. medicine kits, rescue equipment, survival kits, warning equipment, firefighting equipment, evacuation equipment (boats, transport) etc.
- Establish safe storage of essential items near vulnerable locations; e.g. food, medicine, rescue equipment, earth moving machinery etc.
- Establishment of temporary shelters at vulnerable locations to host affected people; local level emergency response teams comprised of the residents and local relief distribution teams
- Coordination and networking among all stakeholders

Flood-Risk Amplification Communication Theory

A critical prerequisite to effective disaster management is the minimization of related impacts through communication of risk information in a timely manner and in a format that all stakeholders can understand. Attaining this mandate can be a major challenge for disaster managers, especially in an increasingly globalized world characterized by higher levels of multi-culturalism as increasing numbers of people migrate to

locations outside their culture-zones where, not only language differs, but also perceptions of and attitude towards hazard/disaster risk (Martin, 2003). The challenge for disaster managers is therefore to design effective tools/strategies that not only span language differences, but also take into consideration cultural perceptions and attitudes so that the objectives of disaster risk-reduction can be achieved. Moreover, it is also best to explore the community based adaptation measures to building more resilient communities as it is “a community-led process, based on communities’ priorities, needs, knowledge and capacities, which should empower people to plan for and cope with the impacts of climate change” (Reid, 2015) and ultimately makes community more resilient to natural disasters and enable them to pursue dynamic future despite the challenges of these disasters.

Results of the study show that the flood vulnerable communities are composed of individuals from different cultures due to the migration of populations towards the urban communities. Alexander (2012) emphasized that culture is a set of nested phenomena, thus, people respond to different cultures related to national, regional and local settings; peer groups, families and workplaces; ethnic and social groups; gender and race; and interest groups. Moreover, culture undergoes a constant process of metamorphosis as it adapts to the changing circumstances of the modern world and how we

are able to interpret it. As a result, there are very few reliable measures of culture. If one wants to promote change, success is more likely if it is compatible with the prevailing culture, while if it runs against the culture, the adaptive process is likely to be blocked for apparently illogical reasons. Moreover, Simon (as cited in Alexander, 2012) viewed that culture is dynamic, thus, a lot of factors can still be utilized to explain the relationships of man, environment and the institutions. These factors are important sources of cultural uniformity that would allow the community-based comprehension, appreciation and response to disaster situations. Hence, it encourages the idea that communities can help develop participative approaches in building localized and participatory strategies for disaster resilience (O'Neill, 2004; De los Reyes & Francisco, 2015; Kafle & Murshed, 2006).

Similarly, social vulnerability models (Wisner et al., 2012; Gall, 2013; Abramson et al., 2010) to disaster can be utilized for future disaster resilience studies that can further examine the relationship between man and environment towards a human-ecological dimension. In the process, the Systems approach can better explain and show the inter-relationship and integration of man, environment and the institutions, showing that the existing approaches in disaster studies are linear, thus, fails to look at the human ecology aspect of the situation (Stokols et al., 2013). Consequently, Alexander (2012)

proposed an alternative approach to the study of disaster resilience to address this gap in the area of disaster and resilience studies showing the possibility of evolution of human ecological models of disaster from a linear to a transactional approach, incorporating culture as part of the equation, thereby, contextualizing the study of disaster and its impact to humans and environment. Increasing knowledge of disasters and the social processes involved, and the complexity of life in the early 21st century, suggest that a new model ought to be formulated which reflects the vulnerability of human socio-economic systems as acted upon by physical hazards (whether natural or anthropogenic), as well as cultural and historical factors. Thus, a social-ecological approach provides a deeper understanding of the complex, trans-disciplinary and dynamic processes of adaptation and counter-adaptation highlighting the interplay of human and ecological systems integrating the scientific-physical systems knowledge, symbolic-experiential and socio-cultural systems (Stokols et al., 2013).

Utilizing the results of this research from the concerned agencies and the communities' awareness and assessment of the communication systems and the perception, behavior and experiences of the flood-vulnerable communities provided the inputs on how to design and develop a risk communication management appropriate for the context of Davao City.

The following significant gaps were considered in the proposed framework:

- (1) The current communication systems implement a “top-down” approach and the feedback mechanism is weak or very limited.
- (2) The concerned agencies, which, may serve as the “amplification channels” can tailor-fit the risk messages according to the context of its target recipients.
- (3) The ripple effect as presented by SARF shows that the extent of reach does not transcend towards the household levels.
- (4) Risk perception and awareness of risk messages may be present, but the preparedness level of the communities can be attributed to the experiences that they had on flooding.
- (5) Assessment of the risk communication systems was significantly based on their familiarity of the communication tools as sources of information on flooding.

A community-based adaptation could be in the form of a flood-risk communication management at the community level and making it the central source of the amplification to address the dynamic, transactional and localized approach. Thereby synchronizing the DRR approach at the community levels. Specifically, focusing on the following major key areas:

- (1) Strong community-participatory focus – encourage collective mitigation and response strategies
- (2) Empower the communities to establish DRR strategies that are context-specific to their situations and experiences --- enhance indigenous/local DRR knowledge
- (3) Provide capacity-building trainings to the community
- (4) Encourage effective and appropriate use of the communication channels and tools

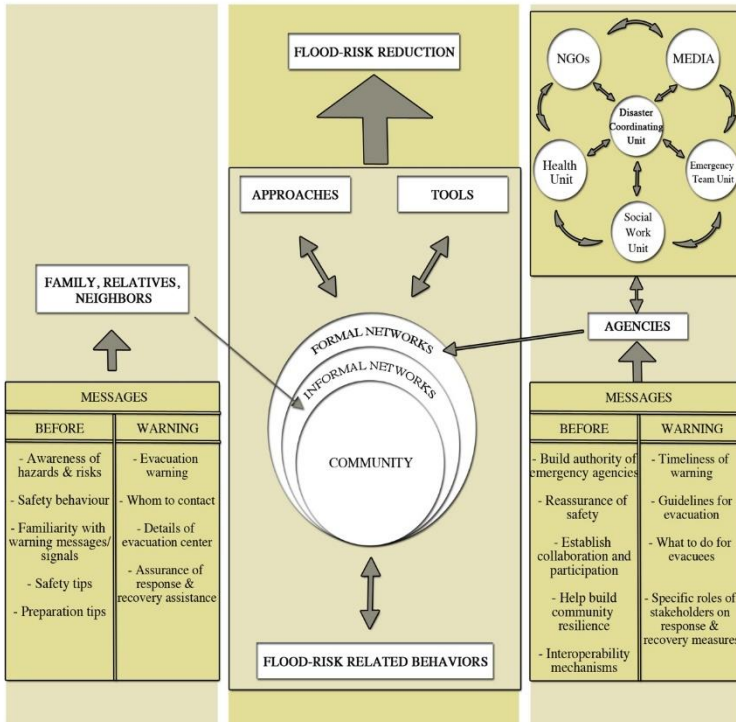
Figure 26 shows the community-based flood risk communication management framework, adopting the SARF model to highlight the different stages of the process. The modification in the SARF is the integration of the community-based inputs like the community’s perception of risk, experiences on flooding, awareness of the communication systems, their attitude and assessment and their practices. As the results of the study show that the extent of reach as to the barangay level only covers level of officials of the barangay, it should be part of the proposed theoretical framework that the community level should be considered as the sources of information as regards their experiences and adaptation practices on flooding incidences. The central element, then, would be the individuals at the community level who amplify the experience through an integrated amplification system which integrates the amplification stations with the “ripple

effect” or reach of the community’s flood experiences and practices to include the informal social networks (family, relatives, neighbors) as well as the formal social networks (opinion leaders, different volunteer groups, media and non-government agencies). From this, a strategic triad for risk communication would determine the appropriate messages that are context-specific to the different vulnerable communities reflecting the lessons based on the experiences and its role in the communication planning that would account for the selection of the approaches and tools. The information mechanisms involved shall be coupled with the selection of the appropriate communication messages that will be utilized in the communication materials. This, however should be guided by the institutional mechanisms that have been crafted integrating the local communities’ context, dynamics and capacities. The strategic risk communication can be utilized for the risk reduction and management at the community levels, utilizing the interoperability of the agencies involved and inclusion of the BDRRMCs who implements the strategies, monitor its outcomes and gather feedbacks at the level of the communities. Compared to the original SARF which has a linear “top-down” communication system, the proposed theoretical framework will generate its information system from the community’s inputs as to their reception of the risk

messages, awareness of risk, their flooding experiences and their level of preparedness.

Figure 26

Community-based flood risk communication management (CBFRCM) framework



Since results of this study revealed that the practice of the communication systems on flood risk is top-down approach and have some areas that can be improved by engaging the communities, a localized and participatory strategy is encouraged. Respondents of this study expressed that sharing of best practices and their experience in flooding

can be on strategy to strengthen the awareness and preparedness level among them. Hence, the same strategy as espoused by the Canadian guide to effective flood risk communication (Mackinnon et al., 2018) can be adopted to address the SARF model's integration of the community as the amplifier or attenuator of the risk messages instead of the concerned agencies. It is hoped that an interactive collaboration would translate into a more appropriate and effective flood-risk communication management for Davao City.

The Elements of the Flood-Risk Amplification Communication Theory (FRACT)

The **Flood Risk Amplification Communication Theory** as a proposed framework reflected in Figures 26 and 27 recommends that the community becomes the main actor in the amplification of risk. Hence, a shift from event centered to people centered approach. The flood-risk behaviors of the communities serve as the major source of the messages involving the integration of all the stakeholders into a strategic risk communication approach towards flood-risk reduction. Moreover, it also involves the interdependent transactional process among the following elements:

Strategic Risk Communication

The US Food and Drug Administration (2009) and the Ministry of Health in Canada (2006) both defined strategic risk communication as a “purposeful process of skillful interaction with stakeholders supported by appropriate information” as an essential component of integrated risk management. It can help decision-makers and stakeholders make well-informed decisions leading to effective risk management.

Results of the study show that interoperability among agencies is the focal emphasis on disaster management, however, there is still a lack of risk communication management which aims to address the integration of risk communication with disaster management.

Since risk communication is described as “an interactive process of exchange of information and opinion among individuals, groups and institutions about the nature of risk, people’s perceptions, and actions that can be taken to deal with the risks” (Rafle & Murshed, 2006), it would be beneficial if this can be a replicated approach in all the stages of the disaster management cycle. In this context, the dynamic interconnections between and among the “amplification stations” involved as well as their specific role in the communication process and organizational linkages will be considered central to the implementation of the strategic triad which would consider both the reach of the information and

the appropriate approach and tools to be used including the channels and messages therein. The conceptualization, planning and designing of the risk communication system would involve the integration of the amplification and reach as the core element of the risk communication and framed accordingly within the strategic triad of communication. Thus, the crafting of the risk communication at the community level would involve a participatory approach which is guided by the appropriate institutional mechanisms and can provide a risk management approach for implementation of the different agencies involved in an interoperability mechanism which include the community engagement and individual inputs.

Results of the study also reflect Kasperson et al. (1988)'s view that amplification occurs at two stages the in the transfer of information about the risk and in the response mechanisms of society. Social amplification of risk denotes the phenomenon by which information processes, institutional structures, social group behavior and individual responses shape the social experience of risk, thereby contributing to risk consequences. The amplification stations or the "filtering of signals" involve the information systems and the communication channels to determine the reach or the "ripple effect" of the information. This process involved that the individual is a separate component from the social amplification stations, this framework, however, proposes that

the amplification starts from the individual and integrates the amplification stations with its reach to have a dynamic and transactional process of direct and indirect effects that can influence the strategic planning of the communication system.

The individual's risk perception revealed in this study is influenced by the experiences in flooding and therefore creates self-imposed behaviors and responses to flooding incidences. Cantrill (2011) emphasized that the role of individual perceptions is the result of overlapping sets of cognitions, both arising from experience that create the person's personal vision of their role and connection to the environment. This can provide dynamic and integrative perspective for understanding the relationship between psychological predispositions, social interactions and the perception on a local level. Thus, it can serve the value of consciousness of local citizens to cooperate with others to achieve desired outcomes. Moreover, Weinstein (1989) viewed that personal experience is widely believed to have a powerful impact on the recognition of risk and the willingness to take extra precautions. The interest in prevention that seem to follow disasters is viewed as evidence of the effects of experience. O'Neill (2004) has also noted that several studies have highlighted the role of personal experience of disasters as a driver of heightened risk perception, thus, creates self-protective behaviors. This is also supported by scholars like Krimsky and Plough (1988) who observed that

the perception of threats must be viewed as social construction and the social amplification of risk (Kasperson, 2001; Pidgeon et al., 2003) and suggested that individuals encounter interpersonal or mass-mediated account that heighten or diminish the significance of an issue.

Goal towards Flood-risk Reduction

A community-based approach accounts for the implementation stage utilizing a multi-lateral knowledge development approach combined with the interoperability or the dynamic interconnections between and among the agencies involved as well as the inclusion of the community and individuals in the process.

The findings of this study revealed that local residents of the flood-vulnerable communities had experiential knowledge on flooding that has helped them create practices to reduce vulnerabilities, it can become a useful tool in crafting the risk communication appropriate in the context of the flood-vulnerable communities. An effective output that can be developed from a multi-lateral knowledge development is the creation of an integrated Early Warning System (EWS) at the community levels. The risk communication infrastructure would address the appropriate tools for specific audiences and identify the effective interaction among the main actors such as the scientific community, decision makers, stakeholders, the

public and the media. Close coordination between the community, the experts and other concerned groups should work towards a “tailor-fit” and specific approach using the multi-lateral knowledge development approach.

Stakeholders

Stakeholders can be viewed as any individual, group, or organization that may affect, be affected by or perceive itself to be affected by potential risk. In the context of this study, the stakeholders include: the community, the informal networks (family, relatives, neighbors), formal networks (the decision-makers of the concerned agencies, particularly, coordinating unit, the health partners, the emergency teams, the NGOs, the media, among others).

Community. Results of the study also show that a review of the past flooding incidences allowed local authorities to identify the vulnerabilities, experiences and coping mechanisms of the community. However, the gathering and documenting of this information in close coordination and consultation with the involved communities has been disregarded. Thus, it lacks recognition on the community inputs that would help analyze the impact of flooding to the individuals and communities at large, reduce their vulnerabilities, timeframe of recovery as well as identify the appropriate resources and capacities necessary to build

community resilience as well as find out their expectations in terms of mitigation and preparedness levels. Respondents expressed that a more effective risk communication strategy and risk reduction and management can be crafted that would address a “tailor-fit” mechanism to address their sentiments and concerns.

This finding is reinforced by the idea that the key aspect of community involvement is the sustainability of the community level initiatives for risk reduction and management. External agencies like government, non-government organizations and other volunteer groups may initiate and implement community level programs for awareness and preparedness, however, if it does not reflect the “realities” of the community, sustainability is threatened by the lack of partnership, participation, empowerment and ownership of local communities (Kafle & Murshed, 2006). Individuals and communities have some vitally important assets to deal with disasters like flooding. The top-down approach fails to address specific local resources and capacities and may even increase their vulnerabilities. A bottom-up approach includes the following general elements which can be adopted for the Davao City context:

- Local people are capable of initiating and sustaining their own community development

- While role of local government, private sector and NGOs is important, the primary requirement for grassroots development is with local leadership
- A successful “localized” strategy will include broad-based local participation in comprehensive planning and decision-making activities that promote motivation
- Educational opportunities should correspond to identified local needs
- Emphasis is on improving the utilization and management of local resources
- Responsible utilization of outside financial assistance is required
- Replication of a community’s success is a powerful factor in continuing local initiative
- Responsibility for change rests with those living in the local community
- Various community members and groups in the community may have different perceptions of risk and varying vulnerabilities

Informal social networks. The acceptability of the respondents of the vital role of the informal social networks (in the context of this study included the family, relatives, neighbors, among others) in their motivation to respond to flooding is also considered. The roots of social amplification

lie in the social experience and an indirect or secondary experience, through information received about the risk, risk events and management systems. Many risks are not experienced directly, when direct experience is lacking or minimal, the social amplification stations take its role. The informal social networks account for the informal communication networks formed through the linkages that exist among families, relatives, neighbors and within co-workers in the workplace (Kasperson et al., 1988). Social and informal networks can provide the information that may work best in raising awareness of the hazard and the associated risks. Moreover, O'Neill (2004) emphasized studies have shown that people make decisions about their response a severe risk in consultation with their family and in the context of the community climate. Communities take a variety of forms based on a sense of cohesion and mutual interest and include spiritual, ethnic, political or through their locality. Thus, communities should be considered as systems: interconnected networks of individuals and groups linked by shared experiences, values, norms and beliefs and these systems can enable or disable a community's response to disaster (O'Neill, 2004). This is revealed in the 2011 Davao City flashflood incident, where the social networks have been the contributory factor in the community's response to the disaster (Cayamanda & Lopez, 2018).

In terms of influence of the informal social networks on the response of individuals to flooding, the results of this study highlight that actions taken by individuals and households are greatly affected by the social networks (Haer et al., 2016). People's tendency to implement protective measures increases when they see their relatives, friends and neighbors implementing measures, either through observations of their actions or by verbal persuasion which confirms Kaspersen's idea of amplification of risk perception is largely affected by the transfer of information through the interpersonal networks. In addition, Scherer and Cho (2003) confirmed that social linkages in communities play an important role in focusing risk perceptions and build "groups or communities of like-minded" individuals.

Formal social networks. Evidently, flood vulnerable communities in Davao are aware that formal social networks also play a significant role in disaster mitigation, preparedness, and response. This is similar to Allen's (2006) view that barangay communities are the appropriate level for community-based disaster preparedness intervention since it has the capacity to collectively identify problems, take decisions and act on them. Moreover, the presence of an administrative identity and formal leadership structure comprising an elected captain and appointed councilors and purok (zonal) leaders form the decentralized local government

system that provide firm foundation for community mobilization. As such, building local coping and adaptive capacity can be enhanced through various mechanisms highlighting the local-specific experience and impacts as the core of the process of identifying, planning and implementing interventions. However, the role of existing structures and community institutions may be overlooked by external agencies engaged in local capacity building due to the multiple functions or inconsistencies with “institutionalized” formats. Thus, there is a need to empower the community by enhancing the capacity of local institutions to access and maintain control of funds, but, performs as part of a wider network. Hence, take decisions and acts independently but operates in collaboration with a bigger network. Integration in formal social networks can increase the potential ability to share knowledge, accountability and empowered decision-making at community levels as well as encourage strategic thinking in a more long-term capacity.

Flood-Risk Related Behaviors

The communities have expressed that there are concerns that needs to be addressed as to the politics, policies and communication system at their level. It was shown that their assessment of the barangay efforts was influenced by their familiarity of the communication tools as sources of

information, however, their preparedness and response on flooding was based on their experiences with flooding. This represents the lessons which account for the listening to what the flood vulnerable communities have to share and say, their understanding of risk, barriers to communication reception and socio-demographic factors as well as elicit from them stories that may help formulate the localized or contextual approach of the communication. This translates into consultation and public dialogues between the agencies and the affected communities. A more defined structure and regular interaction among the communities can be done to establish linkage and mutual trust. It would also allow the communities to take responsibility with appropriate assistance from the different sectors considered as experts. Dynamic, transactional and two-way communication is necessary. Finally, close monitoring and coordination should be done to document best practices and strategies that would work best for the communities. This would be an opportunity to document feedback and suggestions from the communities that can be used for the improvement of the risk communication system. Moreover, results of the study revealed that the communication networks and flow of communication is usually “top-down” and lacks opportunity for feedback which is not reflective of communication as a dynamic process with a twofold purpose that can foster learning, positive change and

empowerment and that context plays a key role in communication for risk reduction (Abarquez & Murshed, 2004). Thus, the sociocultural context of the flood-vulnerable communities as well as gender perspectives and scale of community (rural, small or mega) does not determine how communication is implemented and often leads to non-cooperation or non-participation of some individuals. As communication planning occurs in an organizational context and is embedded in institutional cultures with specific agendas, it must take place in a context of risk assessment, risk intervention and risk evaluation, making it a strategy that is executed within disaster risk management and reflective of the community's needs and expectations in most times. Also, social vulnerability is key to determining the methods of communication and therefore people, complex social systems and non-structural solutions should be analyzed. As results of the study revealed that respondents are aware of their vulnerability to flooding, they also accept the fact that they should do something about their situations but lacks the opportunity to do so.

Approaches

This would account for the integration of the lessons from the community-based interaction and the strategies for implementation of the communication plan which includes the

information flow, multi-lateral knowledge development and the interoperability mechanisms. Strategically, it would be beneficial that the community's perception, experience and best practices on flooding be made as part of the "technical" communication coming from the concerned agencies, highlighting the gaps and addressing the misconceptions if there are any. This would show how much is their awareness and perception of risk as well as their personal preparedness level on flooding. This however, should be done based on consultative and interactive process, thereby engaging the community in the crafting of the flood-risk messages and risk reduction management.

Information Flow. Results of the study show that the current implementation of the risk communication system in Davao City reflects a top-down approach wherein the policies and actions in DRR are formulated and designed consistent with the command-and-control and technocratic strategies which involve structures to mitigate hazards, warning systems that are technology-based and one-sided risk awareness campaigns. Frameworks for a top-down approach are dependent on transmission of information and knowledge that initiates from the practitioners, policy-makers or disaster managers. This approach, however, as the respondents confirm, does not address the gaps that may be provided by the local communities since they are the ones affected directly

by the disasters. Hence, a bottom-up approach is being recommended to pave the way for the increasing demand for a community-based disaster risk reduction and management approaches which advances and promotes involvement of the highly vulnerable populations in evaluating their own vulnerabilities, risks and the practices to reduce it. Moreover, it can empower the flood vulnerable communities to be adaptive utilizing their own local resources. However, the dichotomy between the top-down and bottom-up approaches is vital in recognizing that both should be utilized to ensure a more effective, participatory and transactional DRR approach. Similarly, the risk communication system in this framework encourages the integration of the top-down, bottom-up and horizontal communication flow as its structure to encourage the localized, participatory and inclusive approach.

Multi-lateral knowledge development. Although specified in the NDRMP that there should be an integration of the scientific/technical and local knowledge in the disaster risk reduction and management approach, results of this study revealed that the Davao City DRRM practices are implemented using the information designed and crafted by the “experts”, usually relayed through a top-down approach and has little room for feedback from the local communities. This framework highlights the need for the adjustment of technical/scientific information according to the local

knowledge and practices in developing strategies for a community-based risk communication system. It is imperative that the scientific community, decision-makers and the local community should work together to ensure that local knowledge and practices be incorporated with the existing scientific/technical knowledge for a context-specific information which is similar to Okada, Norio and Yoko Matsuda (2005)'s emphasis on a multi-lateral knowledge development can be a perspective for risk communication to increase disaster preparedness at the community level. Creating a community-based disaster reduction approaches is of significance at times where local knowledge, experience, communication networks and social capital are needed to capitalize on reduction of vulnerability and ensure collective response to disasters (Cutter, 1996). The effectiveness of "localized" risk communication is closely associated with internal factors that affect an individual's capacity to access and use information, with external factors related to entitlement properties of communities or individuals at risk and their ability to communicate effectively within a socio-political context. In addition, Allen (2006) stressed that various mechanisms can be employed to build local coping and adaptive capacities which include close coordination with technical experts to understand technical information and work with disaster managers for awareness of risk and

vulnerability as well as trainings for preparedness and disaster response. Mobilizing local people of the community can be strengthened if they are knowledgeable and informed of the risk information associated with the disaster. Moreover, Christoplos et al. (2001) viewed that understanding the complexities of risk and its communication to the public at large is dependent on the significant role of actors and their contribution to create a multi-sectoral operational priorities and programs. There should be a harmonized understanding among the scientific community, government agencies, local institutions, the NGOs and the community. Working on standardization of concepts and information messages that are understandable by all the sectors would motivate for a better and more effective collaboration and collective action at times of disaster preparedness and response.

Interoperability Mechanisms. The results of this study revealed that there is an interoperability of agencies that helped manage risk and disaster communication, however, this is only clear and defined at the higher-level agencies. This finding was affirmed at the community levels, particularly, the flood-vulnerable communities. The integration of the different forms of knowledge, experiences and actions in the practice of a community-based approach can only be possible when all the stakeholders participate and interact in the process. Thus, there is a need to include all sectors concerned from the individual

to the community level up to the national level. This is in keeping with the general considerations in the ‘priorities for action’ within the Sendai framework for 2015-2030 (UNDRR, 2019b) where there is the expected interoperability of the implementation of the policies to address collaboration among agencies for disaster awareness and preparedness through aggressive risk communication strategies, the need to strengthen disaster risk governance and management and the enhancement of disaster preparedness for effective response.

This proposed theoretical framework recommends that the approach be modified to consider communication, coordination and control which is very significant for inter-governmental specifically on risk management (Comfort, 2007; Comfort, Go & Zagorecki, 2004; Comfort et al., 2004) be extended at the level of the communities.

Similar to the findings on lack of appropriate community-based management and interoperability is contrary to an ideal set-up similar to Comfort (2007)’s view that there should be a “common operating picture” so as to encourage clear communication and effective coordination among agencies and interoperability across the multi-sectoral approach is achieved. Moreover, Christoplos et al. (2001) emphasized the role of a multi-sectoral and harmonized approach to disaster preparedness and response can be enhanced through an information system that has been

developed through participatory and collaborative approach and diverse approaches from different actors in the process have been harmonized and standardized.

Coordination has always been the major objective of all disaster management approaches. It means aligning one's actions with those of other relevant actors and organizations to achieve a shared goal and this is dependent on the effective communication process. Control, on the other hand, in the context of disaster operations, refers to the capacity to focus actions on the shared goal of protecting lives, property and maintaining continuity of operations. Such that this is achieved through shared knowledge, commonly acquired skills and reciprocal adjustment of actions to fit the requirements of the situation. Thus, interoperability plays a significant role in disaster risk management at all stages of the disaster cycle. It can be re-framed as a complex, adaptive system that adjusts to the situation which is dependent on the information infrastructure that can facilitate the process of communication, coordination and control among the participating actors and organizations (Comfort, 2007).

Communication Tools

Communication is very essential in risk reduction and management and may utilize different channels and tools such as written tools in the form of posters, brochures and flyers;

visual tools such as signage, billboards and directional signage; technology-based tools like GIS, internet, and mobile phones; mass media to include television and radio as well as face-to-face communication through trainings, seminars, drills and word-of-mouth. Comfort (2007) states that in emergency management practice, it has focused on the interoperability of mechanical devices such as hand-held radios, cellular phones and landline or telephone networks. However, Clerveaux et al. (2009) mentioned that in some situations, electronic devices may not be appropriate, thus, relay of messages during disaster response can be disseminated through the use of other devices such as loudspeakers, mobile patrol sirens, or oral communication by word-of-mouth among the residents. It can also be counter-productive since the effective working of these devices would directly be dependent on the common understanding of concepts and information among the communicators involved. Hence, if this aspect is to be given appropriate attention, the message contained therein should be harmonized and clearly understood (Comfort, 2007; Christoplos et al., 2001; Clerveaux et al., 2009; Reynolds & Seeger, 2005).

The study revealed that familiarity of tools of communication like use of brochures, posters, billboards or signage, face-to-face engagements, text messages and mass media has been the primary motivators for the high assessment

of the barangay efforts on risk communication. However, it was also pointed out that constraints on manpower and financial assistance becomes a barrier for the full implementation of the information dissemination campaigns at the household levels. To address this concern, it may be useful to engage the community in designing simple yet affordable communication materials that can be distributed among the households. Specifically, the use of factsheets, information cards, family disaster plan for the old to senior sectors of the community; while engage the youth in information dissemination among children through games and story-telling highlighting the risks of flooding and emphasizing on how to respond and behave during flooding.

Adopting Van Westen and Kingma's (CENN, n.d.) categorization of tools and channels of communication based on the needs of the community would basically cover the areas of early warning or awareness to prepare them for eventualities during flood incidences. This can be useful for the risk communication planners in the designing and planning of the messages that would be relayed to their communities. However, it is imperative that the crafting of the risk messages would be developed from a participatory and multi-sectoral approach incorporating the different levels of understanding and appreciation of the information from the different sectors and users of the communication.

Tools	Flood-Risk Messages	
	Early Warning	Awareness
Mass Media (TV, Radio, Newspaper)	X	X
Electronic media (WWW, SMS, MMS)	X	X
Audio-visual (video, audio, multi-media, animation, photographs, model, map, slide show, artwork, graphs)	X	X
Stand-alone print (billboard, poster, banner, warning sign, flood water level)		X
Face-to-face (meeting, seminar, workshop, conference, march, exhibition, demonstration, training, exchange visit, planning)		X
Distributor print (leaflet, pamphlet, brochure, booklet, guideline, case study, newsletter, journal, research paper, report)		X
Folk media (story, drama, dance, song, puppet, music, street entertainment)		X
People (community leader, volunteer, project worker, head of sectoral groups, i.e. tribe, women, youth)	X	X

Flood-Risk Messages

In the context of the study in Davao City, results show that risk communication has been seen as a system to be implemented ensuring the interoperability of the agencies but disregarded the contribution that may be given by the affected communities based on their experiences. This puts emphasis on the idea that conceptualizing the best way to communicate risk have changed over time, specifically, in regard to the incorporation of the individuals and the community in the risk

communication process. Feldman, et. al. (2016) viewed that previous risk communication was seen mostly as a one-way form of communicating with the public being regarded as the recipient of the information based on the expert's view as the salient point of the risk message. However, studies have also shown that gaps in reception were due to the difference of perception of risk between experts and the public (Okada & Matsuda, 2005; Feldman et al., 2016; Oh et al., 2014 Siegrist & Gutscher, 2006). Thus, it is crucial for a risk communication to consider its audience and encourage a participatory framing of the strategies and tools.

Since some of the concerns raised by the residents is the lack of opportunity for them to discuss and share their perception of flood risks and the best practices on response to flooding, they suggested that more community assemblies be conducted whereby dialogue and participation of all affected residents is encouraged. Open communication that can encourage sharing their inputs based on their experiences would enhance the warning systems that they have improvised, a more in-depth discussion on risk and awareness on flooding can translate moving from awareness level to more effective response to risk. Moreover, some technical information that they need clarification can be simplified and transformed into a more understandable risk messages (some of the respondents

shared that some local terminologies may work best for them than the technical terms).

The messages of the risk communication must place the receiver as the central component, hence, the communities are at the center of the risk reduction strategy. Content and interactions that can influence risk decisions and behavior should be included in the announcements, warnings, and guidance documents. The content may cover information that describe the risk event and associated characteristics as wells as encourage appropriate actions to mitigate or reduce the risks. In the context of this study, the focal point of the proposed theory is the pre-disaster stage which accounts for awareness and warning.

The messages for the informal social networks before flooding is targeted towards the awareness and knowledge about flooding which include: understanding of risks, the appropriate safety behavior and safety tips, familiarity with warning messages and signals and preparation tips. On the other hand, warning messages must specifically target uncertainty reduction, self-efficacy and reassurance which seeks to establish reduction in emotional turmoil. Thus, messages at this stage must cover information about evacuation warning, whom to contact, details about the evacuation centers and assurance of response and recovery assistance.

Likewise, the agencies involved must also be adequately prepared and can address the concerns of the communities. Since the approach is localized and participatory, agencies must build authority of emergency agencies as well as establish collaboration and participation from the residents. There is a need to reassure the communities of safety and help them build resilience. The interoperability mechanism should involve a transactional approach which highlights open communication, control, and coordination. For warning messages, critical is the timeliness of warning information relayed to all the stakeholders; specific guidelines for evacuation of residents when necessary as well as the mechanism to address the needs of the evacuees. It should also be clear what specific roles and expectations from all the stakeholders in terms of the response and recovery measures to standardize and synchronize actions.

To summarize, this study recommends a risk communication management approach which accounts for the integration of the findings of the examination of the current risk communication system as well as the awareness and perception of the flood vulnerable communities toward the risk reduction efforts from the national, regional and local levels. Moreover, the assessment of the flood vulnerable communities of these efforts which reflects the “gap” in terms of the localize and participatory approach.

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Appendix A

Summary of the Primary Data Collection

Method	Source/s of Data or Information	Date of Collection
Entry Protocol	Gen. Benito de Leon (Ret.) Head, Public Safety and Security Command Center	Aug. 10, 2017
Key Informant Interview	Mr. Antonio L. Boquiren Head, Training & Research Public Safety and Security Command Center	Aug. 25, 2017
Key Informant Interview	Mr. Sychar Umpig Staff, Office of ABC President January Duterte Disaster Coordinator In-Charge LIGA-Association of Barangay Captains	Sep. 13, 2017
Key Informant Interview	Mr. Rodrigo C. Bustilo Chief, Operations and Warning Section CDRRMO and Central 911	Sep. 28, 2017
Focus Group Discussions	Barangay Officials and BDRRMC personnel Matina, Pangi	Dec. 14, 2017
Focus Group Discussions	Barangay Officials and BDRRMC personnel Ma-a	Dec. 18, 2017
Focus Group Discussions	Barangay Officials and BDRRMC personnel Matina Crossing	Jan. 12, 2018
Focus Group Discussions	Barangay Officials and BDRRMC personnel Bucana	Feb. 2, 2018
Focus Group Discussions	Barangay Officials and BDRRMC personnel Tigatto	Feb. 26, 2018

Appendix B

Consolidated Themes and Cues of the focus group discussions Set A (Barangay Officials)

Themes	Cues
Sources of information (filtering stations)	<ul style="list-style-type: none"> > barangays rely information among the LGU offices, City Disaster and Risk Management Offices, Phil. Red Cross, NGOs, schools > National television > weather bureau and City Information Office
Structural Flow of communication (ripple effect)	<ul style="list-style-type: none"> > All barangays observed top-bottom communication protocols; however, there are some barangays who practice bottom-up approach for internal purposes > The barangay captains disseminate the messages coming from the City Disaster Office down to their purok leaders and rely on these officials to disseminate to their communities > In most cases, memorandum is being used to trickle information coming from the National level i.e. updates on mitigating risk in the community levels > Communication tools originate from the NDRRMC or CDRRMO cascaded at the barangay levels for dissemination
Amplification of information	<ul style="list-style-type: none"> > Seminar lectures and trainings conducted initiated by the barangay, in most cases, in collaboration with external organizations, i.e. DCDRRMC, 911, Schools & Universities, Red Cross > No specific schedule of seminars and trainings, dependent on the schedule and budget of the LGU and sponsor organizations > Provide regular weather updates especially during rainfall in the “higher areas” that may trigger flashflood in low-lying areas
Messages used	<ul style="list-style-type: none"> > all barangays reveal that disaster risk trainings and seminars topics include information about earthquake, fire, flooding > Emergency response and alert level parameters > Information and orientation on the early warning signals i.e. siren/alarm and color coding water level signages > Preparation for disasters, including first aid or emergency responses to help others during crisis situation i.e. drowning or stranded individuals > Prevention tips on fire disasters > Guidelines for evacuation
Communication	<ul style="list-style-type: none"> > for pre-disaster situations --- the barangay makes use of awareness campaigns, like seminars, lectures and flood drills;

Tools & Channels	<p>disseminate relevant information coming from higher offices like CDRRMC, 911 and others; set up of signages and posters for public information i.e. color-coded warning signals and directional signages for evacuation centers (if there is any)</p> <ul style="list-style-type: none"> > for disaster situations --- the use of mobile phones, hand held radios, megaphones, barangay representatives (purok leaders or tanods) roaming house-to-house to give warning of the flooding situation; the use of siren as early warning device, level of expected water signaled by the presence of color-coded warning level alert near the riverbanks > for post disaster --- incident reports and post disaster meetings to evaluate the recent flooding and the action done by the barangay in collaboration with other agencies and the community > word-of-mouth and the use of the social media (FB) were also among the tools for message dissemination
Reception and response to messages	<ul style="list-style-type: none"> > in general, communities are participative and cooperative > pre-disaster --- be prepared and alert > disaster --- presence of mind and focus on the disaster situation and how to react on it i.e. evacuation of the most vulnerable members of the HH i.e. children, women and senior citizens > post disaster --- feedbacks given to address concerns for improvement
Constraints encountered by the barangays	<ul style="list-style-type: none"> > needs assistance on further development of communication tools > effective communication planning may help > no City Ordinance that requires a standardized approach on the DRRM strategies > lack of disaster equipment and facilities in some barangays, i.e. hand held radios, evacuation center/area, early warning devices > structural interventions (bureaucratic protocols are sometimes disregarded over urgency of message dissemination) lack manpower and funds to develop tools
Areas for Improvement for the Management of Risk Messages at the community level	<ul style="list-style-type: none"> > more aggressive pre-disaster campaigns for awareness of the entire community, additional or regular seminar/training > tap or strengthen youth organizations to address children and youth mobilization for disaster situations > women who stay in the households should be given training and awareness for emergency situations where heads of family may not be around > develop a more credible masterlist of the barangay residents for easy reference > siren or alarm be placed in more strategic areas > there should be a ready reference of evacuation planning; interaction protocols and clear-cut communication flow among the different agencies involved in the disaster situations > additional communication equipment especially hand-held radios for the purok leaders for faster communication relay

	<ul style="list-style-type: none"> > clamor for review of the urban planning issues especially on residential communities near the riverbanks > relocation of residents that are highly vulnerable to flooding > translate residents' experiences and good practices into a formalized "tips" and share among similar flood-prone communities
Plans and Targets for further Intervention on DRRM Strategies	<ul style="list-style-type: none"> > develop communication tools and intervention strategies for the PWDs and the senior citizens, as well as the children population for a ZERO-CASUALTY during disaster situations > collaborate with sponsor agencies to help develop a disaster-resilient community in terms of infrastructure and community-based disaster response protocols > PDAT (purok disaster assistance teams) or CRT (community response team) should be activated in all flood-prone communities > develop more aggressive awareness campaigns and not rely only on "experiences" to respond to disaster situations like flooding

Appendix C

Focus Group Discussions among the flood-prone communities

Date	Barangay	Duration of FGD	No. of Participants
Dec. 14, 2017	Matina Pangi	90 minutes	10
Dec. 18, 2017	Maa	55 minutes	8
Jan. 12, 2018	Matina Crossing	30 minutes	7
Feb. 2, 2018	Bucana	45 minutes	10
Feb. 26, 2018	Tigatto	35 minutes	6

Appendix D

Consolidated Themes and Cues of the focus group discussions Set B (Residents of flood-vulnerable communities)

Themes	Cues
Experiences in flooding	<ul style="list-style-type: none"> > majority of the residents shared that flooding is a regular occurrence as an outcome of rainfall, however, through time, the situation worsens > significant flooding experiences : Flashflood 2011 at Matina, Crossing January 2013 at Maa 2002 high tide and Vinta 2017 for Bucana residents 1966 flooding and 2017 flooding without rain for Tigatto, Davao City
Response to flooding	<ul style="list-style-type: none"> > roving to monitor water levels > stay alert and no sleep during nighttime rainfall > seek higher ground, in most affected barangays, request temporary accommodation among neighbors with second storey houses > self-imposed evacuation of women, children, PWDs and senior citizens --- abled-males of the household stay to watch over valuables and property > immediate sharing of information through word-of-mouth > purok leaders initiate house-to-house warning and advise for alertness among households
Effects of Flooding	<ul style="list-style-type: none"> > some casualties during flashflood 2011 > destruction of properties > disruption of livelihood and daily activities > destruction of poultry, vegetation and environment > health risks to communities especially among the highly vulnerable – pregnant women, children, PWDs and senior citizens
Observations/Realizations on the flooding situations	<ul style="list-style-type: none"> > flooding can occur even without rain > barangay officials and LGUs tried to improve intervention in every post flooding or disaster incident > awareness is higher after experiencing the significant flooding incidences > more aggressive DRRM interventions are introduced in response to the high-risk flooding incidences experienced by the barangay/purok > some residents with two-level houses choose not to evacuate despite insistence of the appropriate authorities > some residents near riverbanks initiated improvised tools to monitor the water elevation, with or without rain in the area
DRRM Efforts on Flood-risk Messages and	<ul style="list-style-type: none"> > Seminar lectures and trainings conducted initiated by the barangay in collaboration with external organizations, i.e. DCDRRMC, 911, Schools & Universities, Red Cross > No specific schedule of seminars and trainings, dependent on the schedule and budget of the LGU and sponsor organizations > community meetings initiated by purok leaders

Preparedness	<ul style="list-style-type: none"> > 4P recipients (parent leaders) are tapped as additional manpower for disaster-related trainings and as response facilitators > Matina, Crossing used bridge markings of warning signals for monitoring and preparedness > Matina, Pangi include tree planting as flood-mitigation strategy > disseminate warning information retrieved from DRRMC via text messages, radio communication among others
Topics and Messages of Lectures and Trainings	<ul style="list-style-type: none"> > residents confirm that topics covered by the disaster risk trainings and seminars include information about earthquake, fire, flooding > Emergency response and alert level parameters > Information and orientation on the early warning signals i.e. siren/ alarm and color coding water level signages > Preparation for disasters, including first aid or emergency responses to help others during crisis situation i.e. drowning or stranded individuals > Prevention tips on fire disasters > Guidelines for evacuation
Sources of Information	<ul style="list-style-type: none"> > barangays rely information among the LGU offices, City Disaster and Risk Management Offices, Phil. Red Cross, NGOs, schools > National television > weather bureau and City Information Office
Mediums used by the barangay to communicate information regarding flooding	<ul style="list-style-type: none"> > for pre-disaster situations --- the barangay makes use of awareness campaigns, like seminars, lectures and flood drills; disseminate relevant information coming from higher offices like CDRRMC, 911 and others; set up of signages and posters for public information i.e. color-coded warning signals and directional signages for evacuation centers (if there is any) > for disaster situations --- the use of mobile phones, hand held radios, megaphones, barangay representatives (purok leaders or tanods) roaming house-to-house to give warning of the flooding situation; the use of siren as early warning device, level of expected water signaled by the presence of color-coded warning level alert near the riverbanks > for post disaster --- post disaster community meetings for sharing and counselling purposes > TV and radio announcements, word-of-mouth and the use of the social media (FB) were also among the tools for message dissemination
Timeliness and Appropriateness of the communication	<ul style="list-style-type: none"> > all barangays have established specific internal strategies to disseminate information of flood risk to address the urgency and timeliness of the warning > the informal channels of communication are considered appropriate to meet the time element of disseminating the information

Type of Messages disseminated to the community levels	<ul style="list-style-type: none"> > preparedness concerns > condition or status of the flooding > advise for evacuation > parameters for relief distribution
Comments and Reactions on the DRRM efforts	<ul style="list-style-type: none"> > Matina Pangi has yet to develop a specific program for flooding incidences identify an evacuation center > Maa lacks personnel and communication tools awareness level is high due to flooding experiences self-initiated monitoring for residents barangay initiatives appreciated > Matina, Crossing include information dissemination on rainfall in higher areas like Calinan provide megaphones and whistles to purok leaders and tanods > Bucana identify leaders/point persons on disaster management and readiness siren be provided per purok due to the distance of flood-prone areas more information and trainings on types of siren or alarm warnings > Tigatto review development projects in the flood-prone areas clear roads for faster disaster response designate staff for proper coordination provide additional hand-held radios for easier dissemination of information during flooding incidents > majority of participants feel that relocation is a better option, yet, they cannot afford the cost of such action
Understand ability of Information and Messages disseminated by the Barangay Officials and Purok Leaders	<ul style="list-style-type: none"> > simple and clear > signages include easy reference visuals i.e. pictures or drawings reflecting warning level of risk > Tigatto residents, however, observed that not all areas are reached by the efforts, transfer of information is made possible by word-of-mouth and self-imposed sharing among affected residents
Behavioral or Perceptual Change on flood-risk	<ul style="list-style-type: none"> > more informed = higher level of preparedness > acceptance of limitations of barangay and LGUs = self-imposed preparedness and response to flooding > understanding of the vulnerability of the area = creativity in disaster-resilience strategies in the household

due to the DRRM efforts of the barangay	
Suggestions for the Management of Risk Messages at the community level	<p>> 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</p> <p>> there is still a need to develop a communication management plan at the barangay levels</p> <p>> point persons or in-charge should be identified per purok for better and more organized communication flow in the affected areas</p>

Appendix E

Correlation Coefficients between Socio-demographics with barriers to reception of barangay efforts

Spearman's rho		Age Group	GHMI - Reclassd	YrsReside - Reclassd	No_Chldblw5	SenCit_HH	HHMe - Salary	HHMe - Sch	RespBarrrs - Ndx
Age Group	Correlation Coefficient	1.000	-.030	.314**	-.256**	.315**	-.039	-.267**	.088
	Sig. (2-tailed)		.569	.000	.000	.000	.460	.000	.099
	N	353	353	353	353	353	353	353	353
GHMI_Reclassd	Correlation Coefficient	-.030	1.000	.044	.058	.095	.456**	-.008	-.127*
	Sig. (2-tailed)	.569		.407	.276	.076	.000	.888	.017
	N	353	353	353	353	353	353	353	353
YrsReside_Reclassd	Correlation Coefficient	.314**	.044	1.000	-.146**	.190**	.065	-.075	.086
	Sig. (2-tailed)	.000	.407		.006	.000	.222	.159	.106
	N	353	353	353	353	353	353	353	353
No_Chldblw5	Correlation Coefficient	-.256**	.058	-.146**	1.000	-.051	.053	.126*	-.096
	Sig. (2-tailed)	.000	.276	.006		.337	.325	.018	.071
	N	353	353	353	353	353	353	353	353
SenCit_HH	Correlation Coefficient	.315**	.095	.190**	-.051	1.000	.088	-.127*	.033

	Sig. (2-tailed)	.000	.076	.000	.337		.099	.017	.535
	N	353	353	353	353	353	353	353	353
HHMe_Sal	Correlation	-.039	.456**	.065	.053	.088	1.000	.056	-.084
ary	Coefficient								
	Sig. (2-tailed)	.460	.000	.222	.325	.099		.297	.116
	N	353	353	353	353	353	353	353	353
HHMe_Sc	Correlation	-.267**	-.008	-.075	.126*	-.127*	.056	1.000	-.124*
h	Coefficient								
	Sig. (2-tailed)	.000	.888	.159	.018	.017	.297		.020
	N	353	353	353	353	353	353	353	353
RespBarrs_	Correlation	.088	-.127*	.086	-.096	.033	-.084	-.124*	1.000
Ndx	Coefficient								
	Sig. (2-tailed)	.099	.017	.106	.071	.535	.116	.020	
	N	353	353	353	353	353	353	353	353

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed)

Appendix F

Correlation Coefficients between Socio Demographics with perception of flood

Spearman's rho		Age Group	GHMI_ Reclsd	YrsReside_ Reclsd	No_ Chldblw5	SenCit_ HH	HHMe_ Salary	HHM_ e_ Sch	FldPerc_ ep_ Ndx
Age Group	Correlation Coefficient	1.000	-.030	.314**	-.256**	.315**	-.039	-.267**	-.007
	Sig. (2-tailed)		.569	.000	.000	.000	.460	.000	.903
	N	353	353	353	353	353	353	353	349
GHMI_ Reclsd	Correlation Coefficient	-.030	1.000	.044	.058	.095	.456**	-.008	.102
	Sig. (2-tailed)	.569		.407	.276	.076	.000	.888	.056
	N	353	353	353	353	353	353	353	349
YrsReside_ Reclsd	Correlation Coefficient	.314**	.044	1.000	-.146**	.190**	.065	-.075	-.019
	Sig. (2-tailed)	.000	.407		.006	.000	.222	.159	.717
	N	353	353	353	353	353	353	353	349
No_ Chldblw5	Correlation Coefficient	-.256**	.058	-.146**	1.000	-.051	.053	.126*	-.138**

	Sig. (2-tailed)	.000	.276	.006	.337	.325	.018	.010
	N	353	353	353	353	353	353	349
SenCit_H	Correlation Coefficient	.315**	.095	.190**	-.051	1.000	.088	-.127*
	Sig. (2-tailed)	.000	.076	.000	.337	.099	.017	.527
	N	353	353	353	353	353	353	349
HHMe_S	Correlation Coefficient	-.039	.456**	.065	.053	.088	1.000	.056
alary	Sig. (2-tailed)	.460	.000	.222	.325	.099	.297	.776
	N	353	353	353	353	353	353	349
HHMe_S	Correlation Coefficient	-.267**	-.008	-.075	.126*	-.127*	.056	1.000
ch	Sig. (2-tailed)	.000	.888	.159	.018	.017	.297	.165
	N	353	353	353	353	353	353	349
FldPerce	Correlation Coefficient	-.007	.102	-.019	-.138**	.034	.015	-.075
p_Ndx	Sig. (2-tailed)	.903	.056	.717	.010	.527	.776	.165
	N	349	349	349	349	349	349	349

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed)

Appendix G

FGD Sessions for Set A (Barangay Captains, Purok Leaders, BDRRMC staff)



Appendix H

FGD Sessions for Set B (Residents of flood-vulnerable communities)



Appendix I

Photos of the house structures in the locale of the study



Appendix J

Photos from Bucana, Davao City



Appendix K

Photos from Maa, Davao City



Appendix L

Photos from Matina Crossing, Davao City



Appendix M

Photos from Matina Pangi, Davao City



Appendix N

Photos from Tigatto, Davao City



Appendix O

Photos of Mitigation Strategies



