

Transcending the Pandemic Challenges: Interoperability for Risk Management Among Flood-vulnerable Communities of Davao City, Philippines

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ABSTRACT. Disaster risk reduction and management (DRRM) is commonly done by governments and institutions through dissemination of information and other activities including capacity building, planning, and institutionalization using different channels and tools to build community resilience and optimize disaster mitigation opportunities. The management of flood-risk communities in a large city like Davao City is a difficult task for policy and decision makers as well as disaster managers knowing that the current COVID-19 pandemic poses constraints in the transactional process. Effective and operational communication, specifically in communicating flood risks, relies on the efficient performance of interorganizational integration with organizations and systems observing interoperability.

Risk communication management plays the central role in risk management and the interoperability mechanism enhances the preparedness of local communities. This paper discusses the risk communication systems and protocols of Davao City, accentuating

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how flood-risk information is transmitted to the local communities. It describes the role of the institutions and various communication systems as well as the transactional processes in delivering information about risk. With the COVID-19 pandemic, results showed that there were challenges in the transactional process of disaster risk reduction, especially in flood-risk management. Transcending the pandemic has become a critical priority in the interoperability mechanism of the agencies involved in DRRM as well as in the identification of the appropriate alternative risk communication strategies.

Keywords: *Davao City, flood-vulnerable communities, interoperability, risk communication management, transactional communication*

INTRODUCTION

For years, the Philippines has exerted efforts on disaster preparedness and response, specifically risk reduction. However, there are still some areas that can be enhanced, particularly, risk assessment to identify hazard-prone areas, risk perception, and exposure of people to disasters; integration of risk analysis in planning and development initiatives; and capacitation of people in terms of their risk-related behaviors toward building community resilience.

Development and disasters are interrelated — disasters can both dismantle development initiatives as well as initiate opportunities for development (Stephenson, 1994). In the past, the causal relationship between disasters and socio-economic development was not given attention. Thus, it was noted that disasters were merely acknowledged as part of emergency response and not included in long-term development programming (United Nations International Strategy for Disaster Reduction [UNISDR], 2003). Over time, the effects of disasters involve serious degradation of a country's capability for sustainable development, which translates to modifications of economic programs and priorities of the government (Stephenson, 1994; Stephenson & DuFrane, 2002). Similarly, Harvey (2005) emphasized that the expenses related to natural disasters have increased in recent years, thus, affecting the social and economic factors of the communities. Aside from disruption of the community's livelihood, disasters have long-term repercussions in growth, development, and poverty reduction (Benson & Clay, 2004; United Nations, 2015).

The economic losses caused by yearly disasters have been estimated to cost about USD 520B worldwide and have been documented as the cause of depletion of funds that can be utilized for socio-economic services and protection (World Bank, 2015). Due to heightened awareness on risks, governments are obliged to act upon developing communities that are disaster-resilient (Bacasma, 2018). Cordero (2018) revealed that as of 2017, the NDRRMC reported the economic cost related to disasters in the Philippines to be PhP 6446B (USD 127.9B) due to the 22 tropical storms, flash floods, and typhoons. Moreover, the cost of damages has been estimated to be PhP 100B (USD 5.25B). This excludes damages to private properties, economic activities, and revenues from an overwhelming number of people who die from a certain calamity. Similarly, UNISDR estimated that the cost of disaster in the Philippines accounts for 0.8% of the GDP since it affects mostly production of goods and investments, translating to imbalance in payments, employment, exchange rate, and inflation (Cordero, 2018; World Bank, 2010). In 2013, Typhoon Haiyan (Yolanda) devastated the country with total damage and losses reaching PhP 571.1B (USD 12.9B) (World Bank, 2015).

The Philippines' exposure to frequent typhoons and storms makes it vulnerable to flooding and climate change (Lasco et al., 2009; Magalang, 2010). Annually, several typhoons in the Philippines often cause landslides, flooding, and loss of lives. Thus, it is important that environmental, risk, and crisis intervention efforts are applied in the best way possible to minimize physical, social, and environmental damages (Romolini et al., 2016; Seebauer & Babicky, 2018). Flooding, in particular, greatly affects developmental initiatives, specifically in the urban areas. Managing disasters translates to financial restrictions and requires the government to play an active role in risk reduction and reduced community exposure to hazards (Meyer & Rowan, 1977; World Bank, 2015). This has implications on the development of the city, including its social and physical dimensions (Auzzir et al., 2014; Romolini et al., 2016).

The growing literature on disaster-related communication show that risk communication can be an effective tool for planners and researchers to include local people in addressing concerns on climate change adaptation and disaster risk management (Pearce, 2003, as cited in Samaddar et al., 2015). However, its actualization is still far from reality. Risk communication is part of risk governance toward disaster mitigation, preparedness, response, and recovery (Nahapiet & Ghoshal, 1998). Thus, risk communication is usually aimed to: 1) inform people about risks (Palenchar, 2008); 2) improve awareness on possible disasters and develop behavioral changes in response to disasters (Norris et al., 2008); 3) change people's attitude toward preparation (Sanchez, 2014;

Montajes, 2015); and 4) eventually change their behavior (Sanchez & Sumaylo, 2015).

Since risk communication is a transactional process of communicating among stakeholders about the nature and associated risks of a hazard and improving delivery mechanisms to minimize risks, it can be argued that behavioral change is vital in risk communication. Risk communication must be viewed in the context of the community's safety under the four stages of disaster emergency management covering mitigation, preparedness, response, and recovery (O'Neill, 2004). Similarly, Khan et al. (2008) described the disaster cycle in three phases, which are associated with disaster management activities, as follows: (1) the pre-disaster phase, where risk reduction is necessary for mitigation and preparedness; (2) the disaster phase, which involves emergency response activities; and (3) the post disaster phase, which focuses on recovery and rehabilitation of the affected communities.

Every stage of the disaster cycle needs different types of messages because people can have varied and changing perception of risks. Moreover, a shift from response-oriented to a participatory approach needs integrating these elements with the following strategies: integrated planning at the grassroots level, greater collaboration among community members, and people-centered approaches. In addition, this also requires a shift of the community attitude toward risk reduction from merely being receivers of risk communication messages to being integral parts of the message conceptualization and development (O'Neill, 2004). O'Sullivan et al. (2012) stressed that a top-down communication flow restricts change and that there is a need to engage communities for a more effective disaster risk reduction strategy. Moreover, the social dynamics should be considered to integrate political and social dynamics involved in the transactional process (Terpstra et al., 2009; United Nations, 2015).

The Disaster Risk Reduction and Management (DRRM) Act of 2010 provides directive from the national to the local units or *barangays*¹. The National Disaster Risk Reduction and Management Council (NDRRMC) is empowered with the "policy-making, coordination, integration, supervision, monitoring, and evaluation functions" (National Disaster Risk Reduction and Management Plan [NDRRMP] Manual 2011-2028, n.d.). Institutionalized at the regional level down to the local level, the Council represents a multi-sectoral approach on dialogue that involves religious services, civil institutions, and private sectors.

¹ A *barangay* or village is the smallest unit of the Philippine government.

The NDRRMC identifies then checks on the areas that are flood-risk using hazard maps from the United Nations, and displays the identified areas prone to flood and natural hazards as provided by the Meteorological and Geosciences Bureau. In addition, NDRRMC verifies information from other sources like the Philippine Atmospheric Geophysical and Astronomical Services Administration (PAGASA) and Project NOAH (Nationwide Operational Assessment of Hazards), which oversee the weather patterns and the rain levels in the Philippine Area of Responsibility. These institutions help in predicting weather conditions and in detecting the formation of typhoons. Over the past years, the Philippines had been exposed to catastrophic typhoons, namely: Pablo, Pepeng, Santi, Sendong, Ondoy, and Yolanda. All these typhoons caused heavy flooding and tremendous devastation on properties, decline of economic and agricultural assets, and even deaths.

In the past, the Presidential Decree No. 1566 enacted in 1978, entitled “Strengthening the Philippine Disaster Control and Capability and Establishing the National Program on Community Disaster Preparedness” was one of the national policies that addressed DRRM (Saño, 2010). Subsequently, Republic Act (RA) 10121 or the NDRRM Act, along with the NDRRM Plan (NDRRMP) of 2010 gives constitutional guidelines for programs, policies, and plans in responding to disasters. Accordingly, RA 10121 mandates the Office of the Civil Defense to formulate and implement the NDRRMP, ensuring that it aligns with the physical framework, social, economic, and environmental plans of the communities, cities, municipalities, and provinces. The NDRRMP is designed toward building of Filipino communities that are safe and disaster resilient.

At present, the NDRRMP functions as a framework for responding to: 1) disaster prevention and mitigation, 2) disaster preparedness, 3) disaster response, and 4) disaster rehabilitation and recovery. Using geohazard maps and continuous communication with major agencies, the NDRRMC conducts risk assessments and decisions to figure out the country’s susceptibility to natural disasters. Also, community-based efforts have been established through the *Barangay* Disaster Risk Reduction and Management Plans (BDRRMP), which are expected to protect public and private organizations from any form of disasters, hazards, and other risks.

The BDRRM Councils (BDRRMCs) were established using structures that are applicable at the *barangay* level. The *barangay* officials work together with the private sector and local and international organizations to implement projects in disaster-prone areas including

information, education, and communication (IEC) campaigns to equip communities for disaster response (Villanueva, 2016; Sanchez, 2014; Sanchez & Sumaylo, 2015).

Although there are established policy frameworks on DRRM that encourage collaboration among various institutions, the COVID-19 pandemic has posed challenges in the transactional process particularly in risk communication. Effective risk communication relies on the efficient performance of interorganizational integration among organizations and systems. In a 1977 North American Treaty Organization article, the United States Department of Defense defined interoperability 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).

This paper explores how risk communication plays a central role in risk management and how interoperability mechanism enhances preparedness of Davao City, a flood-prone area in southern Philippines. Specifically, this paper asks: “How is flood-risk communication transmitted to local communities employing the risk communication systems and protocols of Davao City in times of the COVID-19 pandemic?” It also describes the current communication systems of Davao City and how its local government unit (LGU) addresses the need to develop and implement comprehensive national and local preparedness and response policies, plans, and systems. Additionally, this paper discusses the role of institutions and various communication systems, and explains the transactional processes involved in delivering information about flood risks in the context of the current pandemic.

Although the central government may be in better position to respond to disaster-related concerns due to greater access to resources, the role of decentralization affects disaster outcomes (Tselios & Tompkins, 2017). Hence, some authors proposed to establish local government institutions and mechanism to respond to community needs (Stewart & Rashid, 2011; Wamil, 2010). Moreover, the relationship between disaster outcomes and political strategies is affected by the local representation in the institutional framework (Meyer & Rowan, 1977). Thus, it is critical to understand the role of the institutional frameworks and its policies, mandates, and roles in the risk communication systems as they serve as the filtering stations for amplification or attenuation of flood risks (Kasperson et al., 1988).

METHODOLOGY

This paper is part of a mixed methods research that employed a Convergent Parallel Design in its analytical framework (Figure 1). However, it focuses only on the qualitative part to present the existing risk communication systems of Davao City. The qualitative interpretive part of the study utilized narratives in the form of quotations taken from the key informant interviews (KIIs) and focus group discussions (FGDs).

Key informants interviewed were the heads of the Public Safety and Security Command Center (PSSCC), Davao City Disaster Risk Reduction and Management Office (CDRRMO), *Liga*-Association of *Barangay* Captains (*Liga*-ABC) of Davao City, and Central 911. Data on the structure and function of the agencies, the procedures and implementing policies, as well as the process flow of information on DRRM were collected from the KIIs.

Meanwhile, information on the inter-related coordination, mechanisms, and interactions among the key agencies were gathered from the two sets of FGDs, with five FGDs each. FGD participants came from the five *barangays* in Davao City that are highly vulnerable to flooding such as *Matina Pangi*, *Matina Crossing*, *Ma-a*, *Tigatto*, and *Bucana*. The first set of FGDs were conducted among the *barangay* chairpersons and *purok*² leaders, while community residents participated in the second set. Each FGD had 10 participants and was conducted for 45 to 90 minutes.

Both FGDs and KIIs used a pre-structured interview guide and were conducted in 2018 through a face-to-face approach. In 2020, data collected were revisited and validated through telephone interviews with the CDRRM Officer.

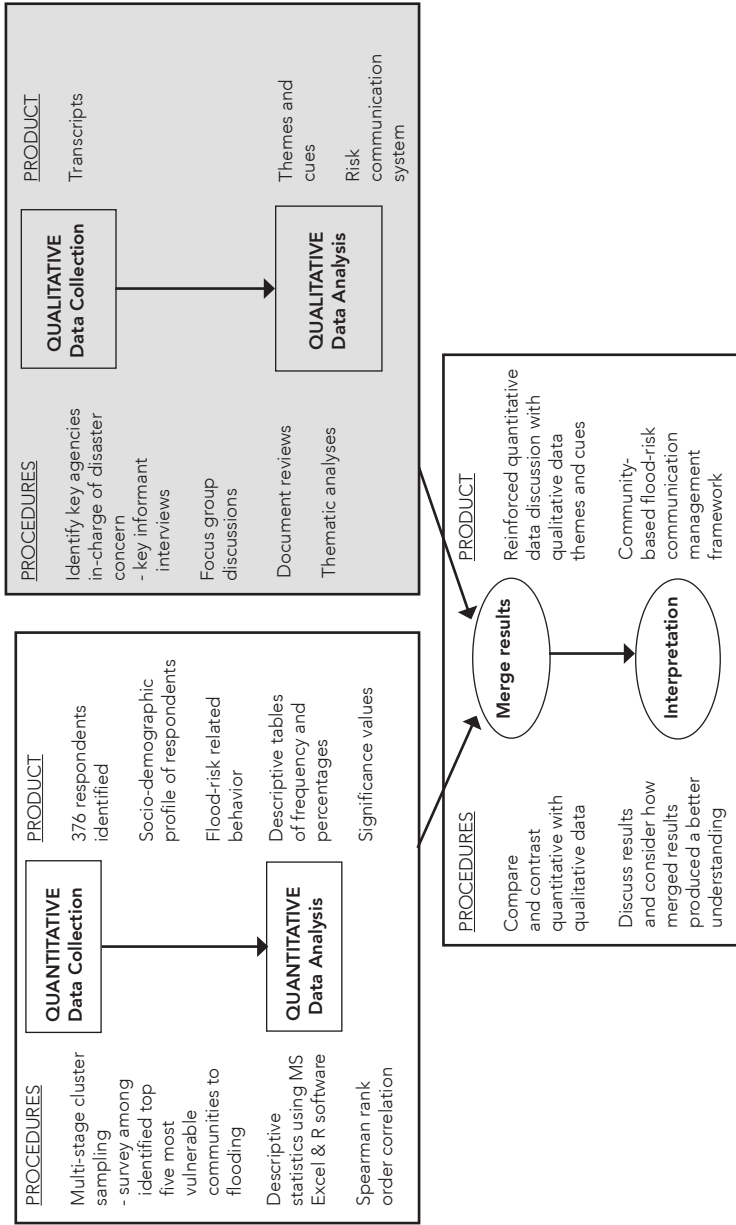
Moreover, secondary data (e.g., executive orders, agency action plans, disaster reports, online publications) were reviewed. Both the primary and secondary data were subjected to policy and content analyses in the context of the COVID-19 pandemic.

RESULTS AND DISCUSSION

The results of the KIIs revealed that Davao City's DRRM is compliant with the DRRM Act of 2010. Likewise, it was found that the DRRMC implements the RA10121 and the NDRRMP.

²A *purok* or *zone* is a political subdivision of a *barangay*.

Figure 1
Analytical framework using the Convergent Parallel Design



Role of the Institutions and Various Communication Systems

The Agencies Involved. The Davao City DRRMC (CDRRMC) has three major agencies involved in the disaster-related concerns of the City, namely: PSSCC, CDRRMO, and *Liga*-ABC.

The PSSCC was used to be the Public Security Command Center (PSC Center), which was in charge of all peace and order concerns in the City. After the devastating flash flood of 2011, which was caused by overflowing rivers due to heavy rains, the PSC Center was renamed to PSSCC to cover all concerns related to the safety and security of the City including all forms of hazards, disasters, and threats. Established in 2012 by virtue of the Executive Order No. 18, PSSCC is under the supervision of the City mayor and is mandated to provide a framework for collaboration, coordination, and interoperability of all offices, agencies, and units involved in safety, security, and crime prevention. The PSSCC also manages the information exchange and dissemination across its clusters (i.e., Davao City Police Office (DCPO), 1003rd Infantry Brigade of the Philippine Army, Task Force Davao, and National Intelligence Coordinating Agency of Region XI) and sub-clusters (i.e., Central 911, CDRRMO, and *Liga*-ABC).

The CDRRMO is another agency crucial to address risk reduction and management concerns at the city level. Established in compliance with RA 10121, the CDRRMO is tasked to set direction, develop, implement and coordinate with DRRM programs within its territory. It is guided by the City DRRM Plan (CDRRMP), which is crafted by the CDRRMC wherein the CDRRM officer sits as a member. The CDRRMO serves as the implementing agency of the national policy in Davao City, covering mitigation, preparedness, response, and recovery stages in any disaster specifically defined under the NDRRMP of the Philippines. Based on the documents provided by the CDRRM Officer and other key informants, the organizational structure of CDRRMO has five sections such as administration, training, planning and research, operations and warning, and Central 911.

The third agency considered significant in disaster-related concerns is the *Liga*-ABC. It was originally formed under Section 491 of the Local Government Code of 1991 for the monitoring, implementation, and empowerment of *barangay* governance. However, the CDRRMC considered the communities as integral in DRRM. Thus, under the same Executive Order No. 18, s2012, the *Liga*-ABC has been considered as one of the sub-clusters responsible for the direct coordination of DRRM concerns at the community level. Specifically, it is tasked with awareness

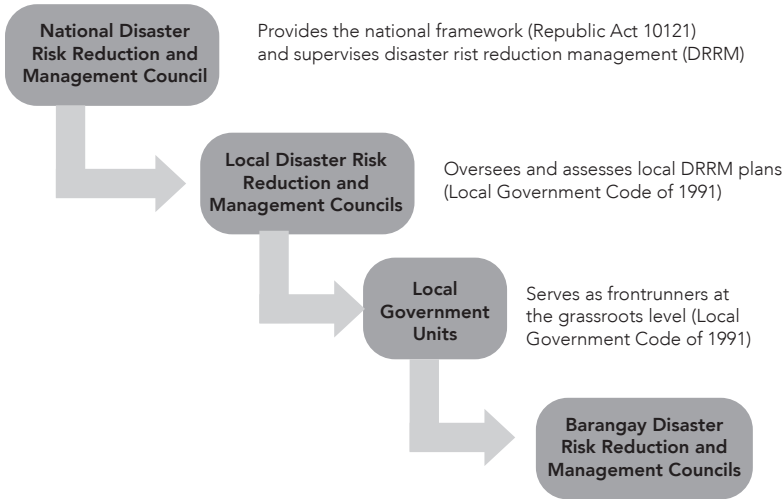
raising and monitoring of disaster and disaster-related concerns, as well as assistance provision for affected barangays. The president of the *Liga* sits as a member of the CDRRMC.

Based on KII, the *Liga*-ABC of Davao City is in charge of coordinating with the *barangay* chairpersons the proposed projects and plans, DILG issuances, and other concerns forwarded to its office. As member of the CDRRMC, the *Liga* president is tasked to monitor and advocate for disaster and disaster-related concerns at the *barangay* level. For instance, the *Liga*-ABC facilitated the systematic and organized conduct of this study through a memo sent to the *barangay* chairpersons of the selected study sites. The set-up adheres to the examined literature on how governance and policies play a critical role in DRRM (Kemp et al., 2005; Koivisto & Nohrstedt, 2017; Nahapiet & Ghoshal, 1988; Romolini et al., 2016; Seebauer & Babicky, 2018).

Organizational Communication Protocols. Information on disaster risk reduction and mitigation follows a top-down approach. Figure 2 shows the organizational set-up of the Philippine DRRM in compliance with RA 10121. Similarly, the bureaucratic flow of communication follows the downward communication flow. At the *barangay* level of DRRM, members of Community Emergency and Response Team (CERT) who are expected to transfer the information to their respective community members are required to undergo trainings. However, one key informant shared the lack of mechanism that would allow the CDRRMO to monitor the extent of information transfer at the household level. This is mainly because CERT members are under the supervision of the *barangay* chairpersons and the *purok* leaders.

This current structure in the flow of communication was affirmed by the participants in the FGD conducted among the *barangay* and *purok* leaders and disaster response personnel. It was further learned that the CERT members do not transfer the information, but it is the *barangay* chairpersons 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 handheld radios. The *barangay* officials and selected residents reported that they closely monitor weather updates during rainy days at flood-vulnerable areas in the uplands for possible flooding in 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 schools and NGOs to deliver these activities for them.

Figure 2
Philippine's DRRM organizational framework
(NDRRMP Manual, 2011-2028)



Majority of the FGD participants also agreed that the *barangays* rely on the information coming from the agencies that serve as the “filtering stations,” where the screening and releasing of information is being done. These include the weather bureau, the City Information Office, the CDRRMO, Philippine Red Cross, NGOs, educational institutions, mass media, and, in some cases, the church. All FGD participants in the implementors group also confirmed the top-down flow of communication whereby the messages that originated from higher agencies are cascaded to the communities. This one-way flow of information, however, has shortcomings. O’Sullivan et al. (2012) pointed out that change is not expected if the flow of communication follows a top-down mechanism. Moreover, some problems caused by political and social dynamics inside the government, key agencies, and the public may affect efficiency of implementation (Terpstra et al., 2009). Operationalizing Kasperson’s amplification of information (Kasperson et al., 1988) is dependent on how the agencies as filtering stations use information, specifically on risk messages.

Transactional Processes in Delivering Information About Flood Risks

Communication Strategies. Figure 3 displays the DRRM framework of Davao City along with the corresponding tasks in the disaster management cycle. These various ideas and approaches are in accordance with the different expected outcomes. In risk communication, the message coming from the agencies involved in DRRM is geared toward the highly susceptible groups in Davao City. As for flooding issues, the respondents disclosed that the emphasis should be to disseminate information to the top five flood vulnerable areas of *Matina Pangí, Matina Crossing, Ma-a, Tigatto, and Bucana* as evident in the Davao City hazard map.

Figure 3
DRRM framework of Davao City
(R.C. Bustillo, personal communication, 28 September 2017)



Interoperability Mechanism Among the Agencies. The PSSCC functions as the central command on public safety issues together with the following government agencies: 1) DCPO, which is in charge of crime prevention, investigation, and suppression; 2) the City Traffic and Transportation Management Office, which oversees traffic management and enforcement; 3) the City Health Office and City Social Services and Development Offices, which do actual and emerging health emergencies and management of victims and emergency shelters; 4) the Central 911, Bureau of Fire Protection, Red Cross, and volunteer organizations, which are in charge of all types of rescue services including fire prevention and suppression and hazardous materials response; and 5) the Davao City Disaster Coordinating Council, Office of the Civil Defense, and Regional

Disasters Coordinating Council, which manage planning and response efforts during calamities, disasters, and other events (Cayamanda & Paunlagui, 2020).

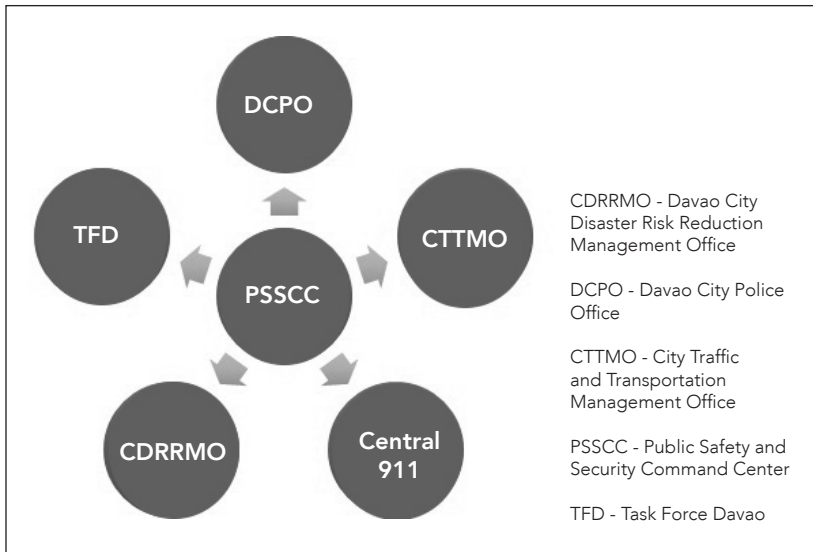
Since 2002, Davao City has been known to be the sole LGU in the country to use Central 911 for emergency response. Nevertheless, its operations were not sufficient in addressing one of the major flash floods that struck Matina District in 2011. This resulted to 29 casualties, material losses, and interrupted commercial activities within the said community. Hence, the Central 911 created an office that would ensure the safety and security of people. Boquiren (personal communication, 25 August 2017) noted that this integration of safety and security in Central 911 complies with the US standard for emergency response.

To carry out this integration, systems in the organization have to 'interoperate' (Kalatzis et al., 2019). By considering the importance of interoperability among agencies, the CDRRM Officer envisions the synchronization among agencies (Figure 4) and emphasizes the substantial role of the local chief executive, the overseer of the PSSCC, in supervising and handling the whole operation. The PSSCC is obliged to preserve and maintain the interoperability of the various agencies for more efficient administration and communication of security and safety issues among the public. Accordingly, Davao City demonstrates active coordination among agencies working together for the safety and security of the community in flood-prone areas. The CDRRM Officer (personal communication, 28 September 2017) mentioned that the LGU is ready in addressing communications at their level. Currently, the LGU is well-equipped, evacuation areas are established, and the City Health Office and City Social Services Department are knowledgeable on their duties and functions should disasters happen. Despite the abovementioned mobility, preparation, accessibility of equipment, and policy for the most serious instances, the CDRRM Officer believes that the best strategy is to enforce evacuation of the residents in the flood-prone areas.

The importance of organizations in addressing risk and in making individuals aware when disasters and other calamities take place was discussed during the KIIs with the CDRRM Officer. The CDRRMO has aggressively conducted information drives despite the inadequate staffing and insufficient financial resources to execute strategies that will raise the state of preparedness and awareness. However, the reality is that the CDRRMO has not been able to develop enough communication materials (e.g., localized brochures, posters, pamphlets). To supplement the lack of communication materials, the CDRRMO has began focusing

Figure 4**Interoperability framework of PSSCC**

(A. L. Boquiren, 2017, personal communication, 25 August 2017)



more on other media such as radio, social media, and cellular phones to connect with the key persons in the grassroots. It has also been focusing on disaster response together with the City Engineer's Office (i.e., using heavy equipment during operations) and City Police Department, which provides support in the evacuation. This set-up reveals a top-down approach with very minimal feedback mechanism and does not reflect a transactional interoperability mechanism.

The results of this study validated findings of previous studies that have examined risk communication from the perspective of the implementors (Comfort & Kapucu, 2006; Comfort et al., 2004a; Haer et al., 2016; Lazrus et al., 2016; Leelawat et al., 2015; Kubicek et al., 2011). In this particular case, disaster or risk messages or materials come from the NDRRMC and are cascaded down to the concerned agencies at the city level. The DILG, CDRRMO, and City Mayor's Office then cascade these risk messages or materials to the *barangays* through the BDRRMC and *barangay* chairpersons who, in turn, send these materials to the household levels through the *purok* leaders.

The interoperability of the agencies at the city level has made communication among agencies more efficient and reliable. Information transfer 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, despite the formal channels of bureaucracy, the use of social media, word-of-mouth, and text messages was observed in the dissemination of information.

Results of this study emphasized establishing community resilience using communication campaigns that will effectively disseminate information, which will lead to community-based preparedness. Once a community-based approach is applied, there would be better disaster mitigation strategies. Communication protocols as well as coordination and control processes should be considered in critical times (Comfort et al., 2004b; Comfort, 2007). Earlier investigations also stressed the need for social ties, relationship building, and inter-organizational synchronization to sustain the strong social capital across the involved communities with diverse organizations (Comfort & Kapucu, 2006; Australian Red Cross, 2013; Oh et al., 2014).

Roles played by NGOs and international volunteer organizations must focus on the implementation process of a community-based information management (Christoplos et al., 2001; Comrie et al., 2019). Moreover, Reid (2016) argued that it is equally best to explore people-centered actions, which will bring noteworthy influence in establishing more flexible communities as messages come directly from the people’s own definition of priorities, needs, knowledge, and capacities. This initiative empowers them to devise a plan that will prepare them for the impacts of natural catastrophes similar to flooding. Likewise, it is anchored on human rights-based methods that adapt to the needs of the susceptible sectors and fully include them in all stages of planning and execution. Also, concrete information on areas to act upon should be cascaded to local institutions and included in the dialogues and decisions of concerned LGUs and development-oriented groups to encourage strong local participation and to ensure the sustainability of development initiatives.

Challenges Posed by the COVID-19 Pandemic

The current DRRM set-up being implemented has been challenged by the presence of the COVID-19 pandemic. While the nation observes the health protocols to avoid COVID-19 transmission,

specifically on social distancing, the occurrence of tropical depressions VongFong (Ambo), Goni (Rolly), and Krovanh (Vicky) in 2020 and Dujuan (Auring) in February 2021 had affected Mindanao areas, including Davao City. There was a need to evacuate more than a thousand individuals. Because of the pandemic, social distancing had to be maintained in the evacuation centers, which made disaster response to be more challenging. The pandemic has greatly affected the transactional processes involved in the interoperability mechanism of the DRRM. Moreover, since the study revealed that interpersonal communication tools were often used due to lack of funds, the pandemic dictates considering alternative modes of communication during disaster response.

Interoperability Mechanisms. Findings revealed that interoperability among agencies help manage risk and disaster communication, but this is only clear and defined at the higher-level agencies. This finding was affirmed at the community levels, particularly, 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 starting from the individual level to the community level up to the national level. This is in consonance with the Sendai Framework for Disaster Risk Reduction (2015-2030) in the implementation of risk governance and management, utilizing the four phases of risk management. The approach should be modified to consider extending communication, coordination, and control, which are very significant for intergovernmental transactions specifically on risk management (Comfort, 2007; Comfort et al., 2004a; Comfort et al., 2004b), at the community level.

The lack of appropriate community-based management and interoperability is contrary to an ideal set-up similar to Comfort's (2007) view. Comfort believes that there should be a "common operating picture" to encourage clear communication and effective coordination among agencies and interoperability across the multi-sectoral approach. Moreover, Christoplos et al. (2001) emphasized that the role of a multi-sectoral and harmonized approach to disaster preparedness and response can be enhanced through an information system that is participatory and collaborative.

Coordination has always been the major objective of all disaster management approaches. It means adjusting actions with those of other important elements among organizations to achieve a shared vision and goals, and this is dependent on the effective communication process.

Control, on the other hand, in the context of disaster operations, refers to the extent of focusing on actions pertaining to a shared goal of protecting lives and properties and maintaining continuity of operations. This is achieved through common knowledge, 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 reframed 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; Comfort & Kapuco, 2006).

The interoperability framework has been proven to be well coordinated and managed through face-to-face and transactional processes. The system relies heavily on the interdependence of the institutions and intergovernmental networks that highly encourage interpersonal cooperation in dealing with strategies related to disaster management and risk reduction. There is now the need to rely more on other mechanisms that can help manage risk reduction among the vulnerable communities.

Navigating Communities in the New Normal: Optimization of the Usual and Alternative Communication Tools

Community resilience and preparedness for disasters like flooding, especially during the time of the COVID-19 pandemic, require an enhanced alternative set of capacities. Likewise, optimizing organizational advantages (i.e., governance, policy-modifications, decentralization of communication efforts, social networks) is very crucial for community resilience and preparedness. 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 (Table 1), the study found that Davao City did not use direct mailing or postal as this would cost the agencies. However, various communication tools were utilized to create public awareness and provide public warnings. These are categorized as mass media, social media, electronic media (e-media), visual tools, narrative tools, and audio tools.

Table 1**Matrix of DRRM Communication Tools***(Faculty of Geo-information Science and Earth Observation-
University of Twente & Caucus Environmental NGO Network, n.d.)*

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, photograph, model, map, slide show, artwork, graph)	x	x
Postal (direct mailing)		x
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

Utilizing Mass, Social, and E-media

Mass, social, or e-media can be applied to all phases of the disaster management cycle as long as communication facilities are still functioning. It can provide information for preparedness as advance warnings and situational updates during the onset of the calamity (Clerveaux et al., 2009; Comrie et al., 2019).

In the Philippines, mass media have been the major avenues for information dissemination at the national level. Majority, if not all, have access to television, radio, or newspapers. In the recent typhoons and storms, it was observed that text messages were utilized by both the NDRRMC and CDRRMO to give weather updates and warnings for

possible typhoons and flooding outcomes. At the city level, the CDRRMO also used electronic media, particularly, social media such as Facebook through the Davao City official Facebook account or the Information and Inquiry Page of Davao City (Figure 5). The CDRRMO also posted signages and warnings on flooding to reach a wider audience, particularly the youth.

The CDRRM Officer (personal communication, 28 September 2017) emphasized the significant role of social media and other forms of electronic communication to make people aware and to upgrade the City’s 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 it admitted that communication efforts should be a collaborative action among different agencies. The text messages of the NDRRMC on weather disturbances and warnings for any flooding and other disasters help them implement its task of influencing the *barangay* to prepare and evacuate if needed.

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 that vividly capture the level of risk of flood-prone areas (Figure 6.) Similarly, a hazard map had been produced by the Department of Science and Technology (DOST), which captures the 100-year rainfall return flood to visualize possible flooding and flash flood incidences.

Figure 5
Sample social media posts

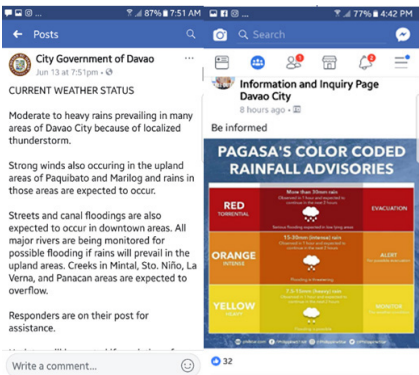
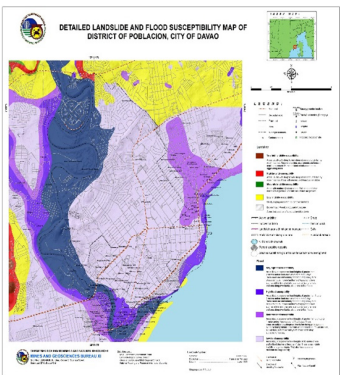


Figure 6
Sample hazard map



Enhanced Use of Visual tools

All tools classified as stand-alone prints are being used, namely: billboards, posters, and banners of warning signs and flow water level. Specifically, the CDRRMO uses the communication tools provided by national agencies such as PAGASA, DILG, and NDRRMC. Examples of these are attractive color-coded posters for rainfall warning (Figure 7) and storm warning system (Figure 8). At the *barangay* levels, signages are also used to give vital information and warnings (Figure 9).

Figure 7
Sample poster on rainfall warning



Figure 8
Sample poster on storm warning system

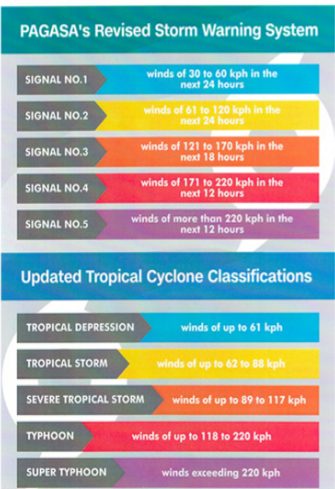


Figure 9
Signages in the barangays of Davao City



The key informants expressed that the shortage of personnel in-charge delimits the creation of more local communication tools. The CDRRMO relies more on the reproduction of materials from the national agencies for dissemination to the communities. Incidentally, brochures or flyers received from the national agencies are also being distributed among the *barangays*.

Strengthened Narrative Tools

For distributor prints, the most commonly used are brochures (Figure 10), flyers, leaflets, and posters (Figure 11) from the NDRRMC and CDRRMO. Research reports and other academic papers are not directly used as communication tools as they often serve as references for decision making. However, the information from these documents are also packaged into billboards or signages. These stand-alone prints are posted in offices, schools, and public areas (i.e., water level sign on bridges).

Figure 10
Sample brochure

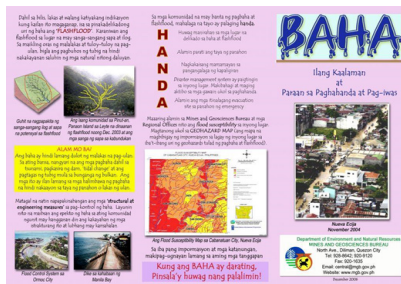
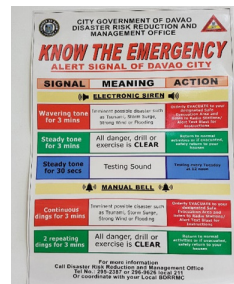


Figure 11
Sample poster



Meanwhile, the posters and brochures distributed to the *barangays* are limited. Hence, the CDRRMO has prioritized the flood-vulnerable communities in the distribution. Some *barangays* with sufficient budget allocation may reproduce these materials to augment the copies coming from the CDRRMO.

The FGD participants validated the distribution of the communication tools from the NDRRMC and CDRRMO. However, majority of them explained that they could not develop or 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 and 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 and community response teams, and 4) develop more aggressive awareness campaigns and not rely only on “experiences” to respond to disaster situations like flooding.

Sustained Use of Audio Tools

In terms of the audio tools that are critical to disaster preparedness and response, the interviewees reiterated the significance of radio communication as the priority channel. Part of the disaster funds of each *barangay* is for the purchase and set-up of a radio communication center. Radio communication also becomes a vital tool for faster and wider scope of information dissemination across the communities, among the concerned agencies, and among the volunteer organizations that respond to any disaster or emergency. Furthermore, it is more sustainable at the community level since it needs low maintenance, and it is easy to operate compared to cellular phones. Moreover, there is also the common usage of loudspeakers in the communities, specifically for early warning signals. Since communication is critical during emergency situations, the most commonly used tools are the audio materials such as radio communication, loudspeakers, sirens or alarms, and ring tunes.

Ultimately, a Strengthened IEC

IEC is made up of the specific components recommended for optimization thus far. A key informant acknowledged that concerned agencies need to improve on specific areas when it comes to responding to flooding and other disasters. In particular, IEC campaigns should be strengthened, and development communication materials must effectively transmit messages to the grassroots. Assistance should be given to CDRRMO to translate the scientific and technical messages on risks into localized language to be understood easily by local communities. Translating general information into localized messages will enhance the appreciation and knowledge of the local people and promote behavioral change.

. The CDRRM Officer also stressed that national government agencies ought to give direct and real time information on the situations: *“So kung tumataas ang tubig, di na kailangan pa na i-analyze pa namin yan* (if the water level rises, there’s no need for us to analyze the technical outputs) because we have no time to do it,” referring to the automatic weather station and radar of the DOST.

CONCLUSIONS AND RECOMMENDATIONS

Davao City is a flood-vulnerable zone based on its geographical characteristics. This is further accentuated by the high population density and riverbank settlements. The results of the study revealed that Davao City adopts a communication system that is compliant with the NDRRMP and the RA 10121, which utilizes a top-down approach in the implementation of its policies, structures, processes, and programs. To understand how compliance is enabled by the the current system of communications governance, this paper examined the role of the agencies along with the management of communication flows under the mandated institutional framework. Findings revealed dominant roles at the level of lead agencies and the necessity of an effective communications system working across stakeholder groups. Moreover, results showed that the pandemic provides another layer of challenge in the transactional process on risk communication.

The transactional process, although present, was observed only among the lead agencies. The interoperability of the communication systems was not yet well-defined at the *barangay* levels. Moreover, the FGD participants in the implementors group expressed that no detailed BDRRM plans as well as communication plan are explicitly followed at the time the study was conducted in 2018. The interoperability mechanism exists among the agencies, and these are considered interdependent of each other. The interconnectedness has been able to deliver a holistic approach on flooding eventualities. However, there is a need to replicate this system at the community level.

Improving public resilience using efficient information dissemination strategies and active community-based preparedness would result to better disaster mitigation strategies. Critical situations call for efficient communication protocols, effective coordination, and proper control. In addition, it is necessary to enhance relationships, social

relations and inter-organizational cooperation to uphold the strong social capital (Aldrich & Meyer, 2015) across the involved communities with diverse organizations (Comfort & Kapucu, 2006; Australian Red Cross, 2013; Oh et al., 2014).

Moreover, flood risk awareness and preparedness can be improved through an integrated flood risk communication management approach (Thieken et al., 2016) that emphasizes the following areas: 1) effective risk communication and management, which lead to appropriate precautionary actions; 2) community participation and inputs of adaptive measures and precautionary ideas, which can help improve a flood risk information campaign; and 3) flood hazard information, precautionary measures, and coping possibilities, which are linked together more effectively to provide context-specific approaches toward risk communication management.

The study of flooding in Davao city is not limited within the jurisdiction of the geographical boundaries of Davao City as it has a myriad of dynamics, factors in governance, and other boundary issues. Thus, it is suggested that stakeholders share efforts and find areas where they can work together despite diversity in political, economic, and environmental interests. The interplay of roles of the government agencies, NGOs, and international volunteer organizations should highlight the operations and results rather than focus on conceptual levels (Christoplos et al., 2001).

Building community resilience becomes more challenging during this time when the COVID-19 pandemic affects not only the implementation of the DRRM strategies, but more importantly, requires a paradigm shift in the approaches for the efficient coordination and collaboration mechanisms that would help navigate the communities in the new normal. This study on the flood-vulnerable communities and how the risk reduction management is affected by the constraints in the face-to-face transactional process in communicating risks has shown the need for possible policy interventions to address current needs. Moreover, there is a need to help the communities navigate and transcend the challenges of the pandemic through alternative modes for efficient information dissemination strategies that are compliant to existing health protocols. Nevertheless, a long-lasting and sustainable view must be applied to every development initiative, specifically on planning development interventions that would ease, if not prevent, the flooding in Davao City.

Policy Recommendations

The focal points for policy action in line with the institutionalization of a “localized” DRR communication intervention in the context of the current pandemic include the following:

1) Review and evaluation of the current communication set-up and the appropriate tools to address the needs of the current situation.

2) Creation of a working group that will integrate disaster communication protocols from the community-level with the plans of the different agencies involved, emphasizing the following concerns: inclusion of the 63 flood-vulnerable communities; examination of the risk perception, local knowledge, and practices in risk reduction; and evaluation of the community’s perception and reception of the current risk communication systems as well as assessment of the LGUs’ efforts on risk reduction.

3) Crafting of a manual of protocols, which contains clear guidelines on how to help communities enhance their flood risk reduction and management mechanisms as they navigate in the “new normal.” The manual will also serve as guide for concerned agencies, highlighting the significant role of the institutional frameworks and interoperability mechanisms vis-à-vis the integration of the community’s varied contexts on disaster incidence.

4) Development of context-specific risk communication messages for different target audiences using appropriate tools that can help navigate and address the communication needs in the new normal set-up.

5) Specification of a timeline for implementation, which includes a corresponding evaluation activity, an appropriate timeframe in the conduct of reception analysis, development of localized materials, and implementation of community-based online trainings and seminars.

ACKNOWLEDGMENTS

The primary author acknowledges the funding support from the PhD Research Scholarship of the Commission on Higher Education, Southeast Asian Regional Center for Graduate Study and Research in Agriculture, and the University of the Philippines’ doctoral studies fund.

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