Community Based Information Dissemination and Communication Strategies for Flood Disaster Planning in the Philippines: A Case Study of Bacolor, Pampanga

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Abstract

Effective information dissemination and communication strategies have been identified as important components in flood disaster planning. This paper presents a case study in the Philippines, specifically in Bacolor, Pampanga to determine the existing framework of communication strategies and information dissemination in a rural setting. A site visit was arranged to Bacolor where first hand data and information were obtained through interviews and an open forum with key officials in the municipality. Relevant thematic and risk maps were also collected and validated through a windshield survey. In addition, a general inventory of the physical communication infrastructure and existing social structure for information dissemination was completed. A textual review of Bacolor's current disaster preparedness plan, specifically their early warning system, was undertaken. The research found that Bacolor has difficulties in effectively informing residents with regard to flooding risks. Factors identified causing the difficulties

include the lack of funding for information dissemination and their top-down structured system for flood communication warnings. Some initial recommendations are to employ low-budget, low technology communication strategies, in addition to encouraging and building the capacity of constituents and non-government organizations to actively participate in emergency information dissemination.

1. Introduction

Pampanga province in the Philippines grabbed the global spotlight with the eruption of Mount Pinatubo in 1991 when an unprecedented amount of volcanic ash caused massive lahar flows, permanently changing the landscape of the province. The explosive eruption on June 15 was the second largest volcanic eruption in the twentieth century and was ten times larger than Mount St. Helens in the United States (Bacolor Comprehensive Rehabilitation Master Plan, 2009). Ash and lahar deposits clogged the main river channel, the Pasig-Potrero, ultimately diverting it to join a small tributary known as the Gugu Creek. While areas adjoining the Pasig Potrero River are now dry, the Gugu Creek regularly overflows its banks (Espresso, 2012; Cruz, 2012). Due to these topographic changes floods have emerged as a major problem, particularly in some ecologically-fragile areas in the municipality of Bacolor[1].

Bacolor presents researchers a unique opportunity to examine the evolution of disaster risk reduction plans from the initial structural investments following an unprecedented disaster to the utilization of community based disaster preparedness to build long-term resilience. In reaction to the cataclysmic destruction caused by Mt. Pinatubo, significant inputs of aid and comprehensive disaster management plans were undertaken (de Guzman, 2005). At this point in time, the Bacolor municipal government organized and operated an effective early warning system and network of evacuation centers[2]. However, as time passed and the unique threat of lahar was replaced by the more widespread threat of typhoon-related flooding, investment in the area decreased causing subsequent deterioration of local and national alliances which aimed to rebuild the area (Cruz, 2012; Rodolfo and Crittenden, 2002). Significant investment continues to flow into structural flood reduction mechanisms such as the construction of megadikes (Bacolor Comprehensive Rehabilitation Master Plan, 2009); yet, the problem of flooding persists as evident in the September 2009 typhoon *Ondoy*, and in the recent "August 4-8th 2012 Monsoon Rain" flood that hit the Northern Philippines (Sun Star, 2012). The emergency warning systems that the Bacolor municipal government operated with success in the past have now deteriorated, placing the residents at higher risks due to delays or inaccuracies in early warning information (Philippines Information Agency, 2012).

The municipal government faces significant budget and capacity constraints as it confronts the task of increasing the resilience of their province to these new flooding patterns (Cruz, 2012). This paper proposes enhancements to the flood preparedness and response communication system for the municipality of Bacolor, which take the budget and logistical limitations into account. A review of best practices worldwide emphasizes the importance of developing effective disaster communication networks using a participatory, community-based approach to increase disaster resilience with limited resources. These systems help decrease the burden on the local government units and increase citizens' trust in and compliance with the emergency system. Utilizing these tools, government and local communities can lessen the impacts of future natural disasters (Aldrich, 2012; Allen, 2006). This research note proposes that Bacolor is at an ideal stage to incorporate community based information dissemination and communication strategies into their disaster management plans. Following a rapid analysis of existing communication systems and ground documentation of local experience, researchers identified an array of low-cost technologies, social networks, and other facilities already present in Bacolor which may be employed in designing and implementing an effective and sustainable early warning system.

A brief description of the study site and the methodology of data collection is provided. It is followed by a note on the existing information dissemination and communication scenario in the locality. The fourth section of the paper highlights in detail the proposed strategies to improve the information dissemination and communication for flood disaster planning in the area. The paper concludes with a summation of these recommendations.

2. Study site and methodology

The study builds on the idea that designing an effective information dissemination and communication strategy for flood disaster planning is a major issue of social and environmental concern. It is anchored on ways to protect human and critical economic assets and seeks to facilitate recommendations and the development of policies in the target area. The site, the Bacolor municipality within Pampanga province, was chosen because it is a high risk flooding area and one of the municipalities in the Philippines that will be greatly affected by climate change due to the increased intensity of typhoons and projected heavy rainfall

changes in coming years. Pampanga was listed as the second highest at risk province in the country for projected climate change disasters by the Department of Environment and Natural Resources (DENR) and the Manila Observatory in 2010 (Cabrido, 2012).

Qualitative methods of data collection were used in this research. The study first gathered an in-depth understanding of the existing communication dynamics in Bacolor. Communication gaps and issues in the emergency warning system were identified. In particular, researchers monitored and reviewed the early warning system in operation during the heavy monsoon rains of August 4-8th 2012 and noted the effects the identified problems had on the timely evacuation of residents. Reasons for these deficiencies were explored, allowing the study to propose interventions to address these gaps through best practices and information gathered from relevant literatures.

Incorporated in the research method were non-probability strategies in gathering data. Convenience interviews and dialogues through an open forum with a panel of key municipal government officials with known or demonstrable knowledge and experience in Bacolor were undertaken. One on one conversations and exchanges of emails and phone calls were also utilized to solicit answers for an array of research questions prepared by the study. A field visit was completed to validate the challenges faced and resources available to improve disaster communication. From this data, researchers analyze, identify, and recommend an array of low-cost, low-technology communication strategies to address emergency information dissemination in the municipality.

3. Information dissemination and communication scenarios in Bacolor

3.1 Previous early warning systems in Bacolor

The government's response to the lahar episodes of the early 1990s is a positive case study in early warning communication systems. The local government units (LGUs) implemented a series of early warning communication methods including sirens, bells, door-to-door canvassing, and two-way radios to respond to the Mt. Pinatubo disaster of 1991. During the years that the lahar flowed (1991-1995), the Mayor of Bacolor posted disaster response officials at various points along the Pasig-Potrero River to monitor the lahar threat upstream. Reports of lahar were immediately broadcasted to the Mayor's office and local barangay captains through emergency radios. All barangay captains were issued these radios and instructed clearly where to evacuate. Captains also designed an alarm system that was most helpful to their town, whether it involved ringing church bells, or sirens. This allowed local participation and ownership in the emergency response system. Furthermore, the emergency systems connected barangay captains and emergency officials in Bacolor to their counterparts in the surrounding areas, particularly in the provincial capital of San Fernando. Thus, if lahar began to flow through a neighboring barangay, Bacolor residents could be warned to prepare or evacuate before the threat entered their area[3].

3.2 State of current emergency information dissemination system in Bacolor

Much of the current communication breakdown in Bacolor during times of natural disaster can be attributed to the inflexibility of the paths utilized in information generation and dissemination. The current single channel communication pathway of Bacolor is not very effective in informing its constituents to flooding hazards. The most serious and disruptive disconnections have occurred between the Pampanga Provincial Government and local community members. A visit to Bacolor's Municipal Government offices in August 2012 revealed that the Municipal Government does not directly monitor national or regional reports from established meteorological information sources. Only the Provincial Government has direct communication with those agencies, unnecessarily separating Bacolor and other municipalities from potentially critical information. Figure 1 illustrates the current single channel communication structure of Bacolor.

Additionally, there are a variety of documented instances where the Municipal Government was unable to communicate the severity of some disaster situations to Barangay Captains either because of technological failures or a lack of teamwork between the parties. Without widespread and reliable technological capability in disaster-prone areas like Bacolor, strong and duel-divectional communication lines and strategies are imperative. Community members are resigned to dependence on a Barangay Captain who may or may not have complete access to real-time information. The Bacolor Municipal Government appears to be the weakest link in the chain of information dissemination due to a lack of resources. Consequently, Bacolor suffers a communication bottleneck where information is not guaranteed to flow swiftly or accurately.

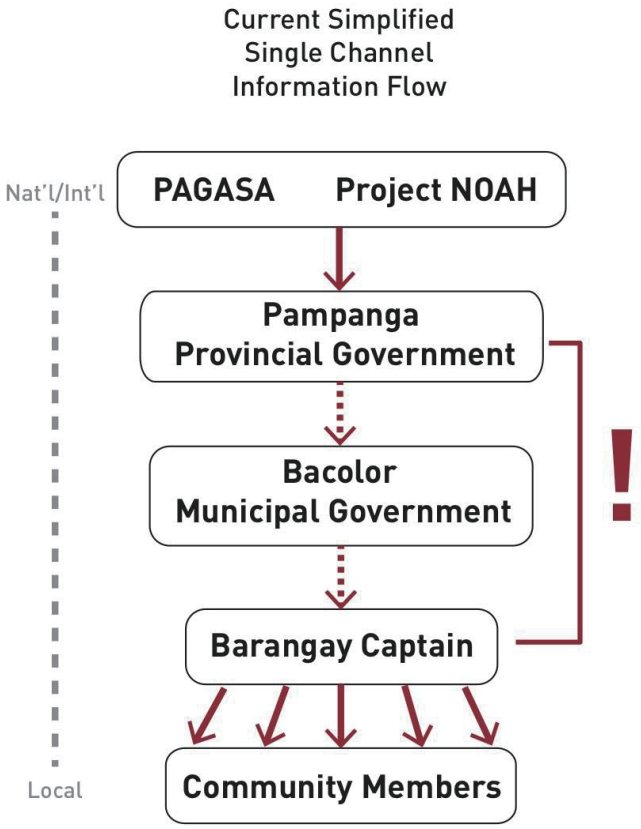

Figure 1. Single Channel Communication Pathway

Visits to the area in August 2012, coupled with discussions with the Vice-Mayor of Bacolor, the Municipal Planning and Development Officer (MPDO), and local barangay captains have shown that as the threat of lahar decreased, the maintenance and effectiveness of the emergency communication system eroded. Due to geological changes, both natural and man-made, the source of flooding is now Gugu Creek, rather than the Pasig-Potrero River. However, emergency officials are not consistently stationed along this waterway to monitor water levels. Local barangay captains are tasked with making the decision to issue an evacuation order; however, they make this decision with minimal information and weather data. Many of the portable radios which were issued are no longer operational, cutting off the most reliable method of communication between LGUs and the barangay captains. In addition, the rain gauges which were called for under the Bacolor Comprehensive Rehabilitation Master Plan were never installed and residents do not monitor national services like the Nationwide Operational Assessment of Hazards (Project NOAH) and the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) for accurate reports on incoming weather systems.

Typically, local captains base their recommendation for evacuation on their personal observations of the water level or rain intensity, without a clear understanding of the length or magnitude of the risk they are facing. Since many inhabitants are extremely hesitant to leave their properties, this often leads to evacuation orders being issued after it is too late to do so safely. In addition, evacuation warning systems themselves have fallen into disuse. A survey of barangay captains conducted by the MPDO regarding the flooding in early August indicated that the most effective and most widely used warning system was for the barangay captain to go door to door. While this may be possible while the population of many barangays remains low, as residents return to the area this system will result in significant delay and may fail to reach all residents in time (Cruz, 2012).

A further challenge in designing an effective information dissemination system in Bacolor is the lack of distinction between evacuation warnings for floods versus floods carrying lahar deposits. In fact, in many barangays the siren systems which were installed are no longer functioning or utilized and an alarm must be sounded with whatever is nearby. There is no clear designation of an alarm sound that corresponds with a particular disaster risk (Cruz, 2012). In a situation in which strong rains persist and an alarm of some sort is sounded, residents may interpret this alarm to indicate lahar flow and react in a panic. As General Jose Fabia, the Director of the Philippines Information Agency (PIA) noted, "Information saves lives." He echoed the desire for clear

emergency information dissemination systems at the Media Briefing Orientation on Disaster Risk Reduction and Management held in Bacolor on July 27, 2012 and furthermore cautioned that informal information systems such as SMS sent by residents can provide inaccurate information and lead to ineffective and/or life threatening decisions if they cannot be corroborated by a standardized source (Philippines Information Agency, 2012).

The ineffectiveness of Bacolor's emergency information dissemination system was clearly demonstrated during the response to the monsoon floods of August 4-8th 2012, described briefly as follows:

- Delayed evacuation orders caused some families to be unable to safely evacuate their homes. Prior to this event, during local trainings and meetings, the LGUs repeatedly urged local barangay captains not to wait until the floods were already high to issue evacuation information. However, despite these warnings several barangay captains waited until the flood waters had already risen, causing some families to be stranded and unable to reach the temporary evacuation centers (Cruz, 2012).

- Lack of communication between neighboring areas caused local captains to be unaware of incoming dangers. Much of the August flooding in Bacolor was caused by the breaching of the Tail Dike outside of San Fernando. Unfortunately, the LGUs of Bacolor were not informed that the dike was breached until the flood waters were already entering their jurisdiction. Barangay officials were forced to make evacuations decisions with incomplete information (Cruz, 2012).

- With no corroborating source, incorrect and asymmetrical information caused panic. As hard rains continued and eventually breached the Tail Dike, a rumor was spread via SMS between residents in San Fernando (where many of the resettled Bacolor residents are located) that lahar was mobilized and flowing (Philippines Information Agency, 2012). Lack of emergency officials monitoring lahar and river flow (as were posted during the 1991 disaster) meant that no official source was able to quickly communicate the inaccuracy of this information to residents. The result was mass panic, with anecdotal evidence pointing to citizens running from their houses and frantically calling family members located in Bacolor to warn them of the incoming danger[4].

It is imperative that the government of Bacolor improves its information dissemination system on potential flood risks, as well as its early warning communication system which provides information to residents on when and where to evacuate. Particular emphasis should be placed on reaching new or recently returned residents who have limited experience with flooding in their areas and are consequently some of the least effective in responding appropriately to risks (Gaillard et al., 2001).

3.3 Pressures to create a functioning communication system

Although the recent flooding episode created extensive flooding that has been compared to the devastation which threatened Bacolor when the lahars flowed in the early 1990s (Inquirer News, 2012), few if any residents in Bacolor lost their lives. Despite areas being stranded by the flooding of the Tail Dike, the floods receded after a few days and residents were able to return to their homes or reach emergency aid and services (Cruz, 2012). However, as the population continues to slowly increase and as the impacts of climate change bring stronger typhoons to the area (Rincon and Virtucio, 2008), the current information generation and dissemination systems will almost surely be overwhelmed. In addition to residents returning from resettlement areas, Bacolor, with its increased elevation following lahars, is predicted to attract residents from higher flood-prone areas of Pampanga due to land subsidence in the province worsening flood impacts. As Bacolor pursues a strategy of resettlement and economic expansion, it is vital that this growth is accompanied by improved and expanded emergency information systems which will protect the lives and livelihoods of current and future residents.

4. Proposed interventions for improving information dissemination and communication

To address the existing limitations of Bacolor's early warning system this paper explores several low-budget, low-technology strategies which may improve emergency information dissemination in the event of flooding. For areas like Bacolor, where funding is constrained such that government is unable to further develop municipal infrastructure for disaster planning, promoting community based disaster management systems (CBDMS) has played an important part in significantly improving safety with limited investment (Allen, 2006). The municipal government of Bacolor can capitalize on the community resources currently available by further decentralizing communication and information networks, conducting extensive stakeholder development, building the capacity of community stakeholders, standardizing data inputs, and exploring alternative funding streams.

The proposed structure for information dissemination is seen as a way to decentralize communication. The research also

seeks to strengthen the relationship of the current national and local government roles and participation in the standardization and verification of information to stakeholders. Scientific knowledge comes from the departments who have the capacity to acquire, monitor and analyze scientific data while stakeholders on the ground maintain local knowledge of the area. The point of convergence will be at the Bacolor Municipal Government. Figure 2 illustrates the current single-channel information flow versus the recommended multi-channel information generation and dissemination structure.

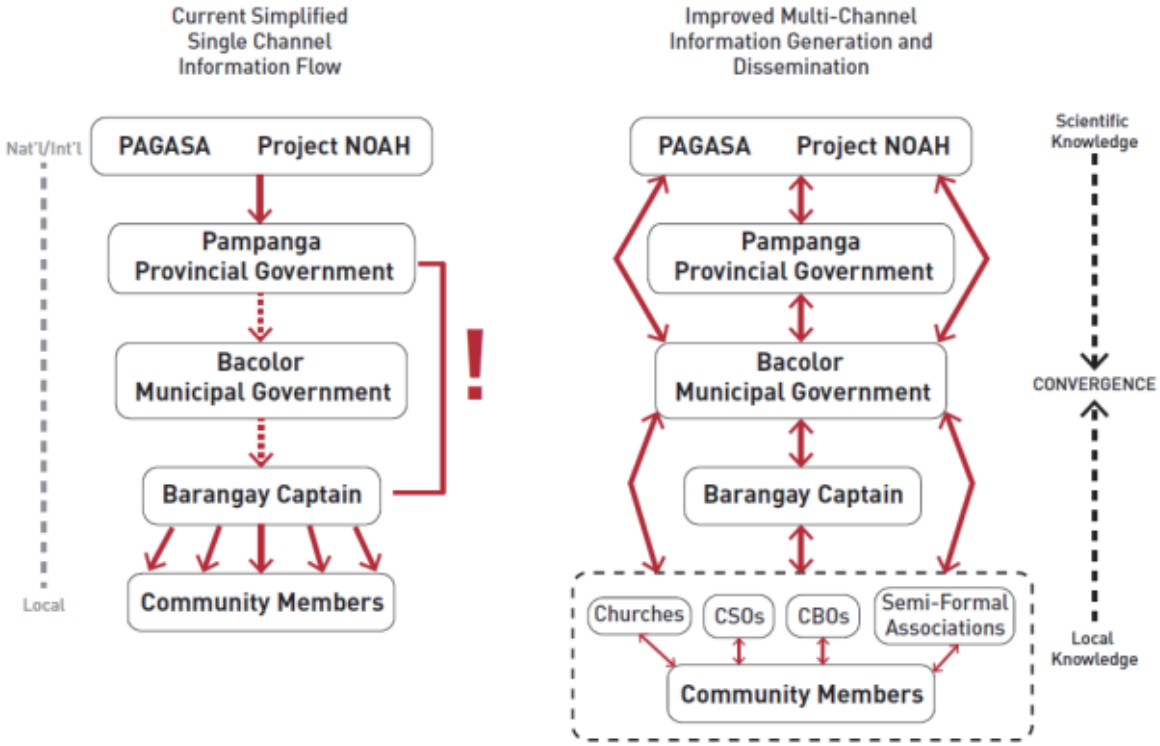

Figure 2. Current single-channel versus recommended multi-channel information generation and dissemination system

4.1 Strategy I: Decentralize communication and information networks

When flooding occurs, one person, the Barangay Captain, is tasked with issuing and disseminating the evacuation orders. This has caused delays, confusion, and inadequate evacuation in response to previous emergencies (Cruz, 2012). To improve the efficiency of their early warning information system, the government of Bacolor and barangay captains can partner with existing formal Civil Society Organizations (CSOs) who have already forged trusted connections with community members. These networks are a potential resource when the municipal government must quickly disseminate accurate emergency information. The following table lists the current CSOs that are considered official partners of the provincial government. These organizations should be involved in information dissemination channels, in addition to new partners representing barangays outside of Calibutbut and Cabambangan.

Table 1. Civil Society Organizations from Bacolor who are partners with the Pampanga Department of the Interior and Local Government

Name of the Civil Society Organizations (CSOs)	Barangay Location
Holy Angel Village VI House Ownership Association (HOA), Inc.	Calibutbut
Promised Land HOA	Calibutbut
The Xevera HOA, Inc.	Calibutbut
Asset Innovators Credit Cooperative	Calibutbut
Calibutbut Multipurpose Cooperative	Calibutbut
DHVCAT Credit Cooperative	Cabambangan
Villa De Bacolor Municipal Employees Multipurpose Cooperative	Cabambangan

Source: www.dilg3.ph

Furthermore, the government of Bacolor is encouraged to draft memorandum of understanding with CSOs and CBOs

throughout the municipality with a particular emphasis on churches or parishes, workers' cooperatives, and semi-formal groups such as Home-Owners Associations (HOAs). The municipality and its various barangays may benefit from increasing the level of utilization of extant community organizations and investment. In the case of Bacolor, local churches, like the Parulog Parish Church in Parulog Barangay, not only have centralized facilities, but also communication infrastructure such as loudspeakers and megaphones, which are typically employed for church announcements. These could be harnessed for the purposes of flood disaster communication.

In addition to having infrastructure in place to sound an evacuation alarm, churches and other community organizations have built trusted relationships with their members. In a study of social capital in Northern Philippines agricultural communities by Milagrosa and Louis (2006), it became clear that what researchers called "Core Trust" was defined by relationships between family members and religious affiliations. With well-developed parish structures and networks, the churches of Bacolor represent an asset. Additionally, the churches themselves are often located in the most threatened areas (Cruz, 2012). Finally, trust in government, while much more likely and possible in very decentralized paradigms, is still harder to develop than trust in community members. In cases where the government is lacking trustworthiness, communication could be more effective and the government's public image could benefit from partnerships with trusted stakeholders.

4.2 Strategy II: Conduct extensive stakeholder engagement

In areas where a centralized system for disaster information is not available for equal distribution of the information to the Barangay officials, more efforts need to be undertaken to regularly collect information from residents. If the barangay captains currently lack access to data monitors along the waterways and must instead rely solely on their discretion and intuition to analyze threats (Cruz, 2012), surely networks of residents can help provide information. It can be considered a low-tech form of crowd-sourcing. When a barangay like Parulog has a very low population density, but covers a relatively large area, it is important to gather data from as many areas as possible from those residents with the most experience preparing for disasters. In many communities, and probably in the barangays of Bacolor, there are methods of risk detection and analysis that are only learned through physical experience and not detected by Doppler radar or satellite images (Ferrer, 2012). Incorporating this local knowledge and low-technology monitoring methods can improve social preparation in the face of repeated hazards such as flooding.

Extensive stakeholder engagement is necessary to generate this social capital and to actively involve Bacolor constituents in improving their emergency monitoring and communication systems. Academic institutions, such as the University of the Philippines, may be a valuable resource to facilitate workshops and focus groups for community capacity building in Bacolor[5]. Topics for training may include exploring low-tech and location specific warning signs of flooding, clearly delineating CSO leaders and barangay officials who will issue official evacuation decisions, deciding on a primary warning method (phone calls, loud speakers, etc), and eliciting feedback from community members on resources available to assist in emergency warning dissemination.

Additional resources for stakeholder engagement at a local level may be provincial or barangay leaders outside of Bacolor who have designed similar effective community-based systems in their provinces. Trainings may be held for Bacolor govermental and CSO leaders, in best practices to engage their constituents in monitoring flood levels and effectively disseminating emergency information[6]. Furthermore, hazard preparedness may be integrated into primary and secondary school curriculum to ensure that citizens of all ages are empowered to know the danger signs and react appropriately to warning signals (Salceda, 2012; Minamitani, 2012).

4.3 Strategy III: Build the capacity of local community based stakeholders

After forging partnerships with CSOs throughout Bacolor, the municipal government can utilize these new networks to hold capacity training exercises and to encourage each group to prepare and practice for emergency evacuations. Training programs can be conducted to educate local partners (church leaders, community association leaders, etc.) about critical early warning information systems. Consequently, those leaders can follow-up by holding trainings and meetings for their constituents utilizing the resources of their organizations, rather than relying upon the already over-stretched resources of the Bacolor municipal government, to reach all citizens.

These community based groups should also be encouraged to actively prepare and practice for emergency situations. By informing all citizens of the warning signs (particularly low-tech signs identified by long-term residents during the stakeholder engagement phase) and the critical points at which evacuation becomes necessary, community members can evacuate when needed, even if they have not received the official alert from the barangay captains. This addresses the problem of delay in evacuation orders causing residents to be unable to safely access the emergency shelters.

However, it is critical to devise feedback mechanisms which mitigate the risk of disseminating false information. As illustrated by the recent panic caused by rumors of lahar flow following the breaching of the Tail Dike, incorrect information can cause individuals to react inappropriately to the risks. Capacity training for community members and organizations on how to accurately identify and interpret warning signs is part of this feedback loop. Knowing the signs and understanding the need to make evacuation calls based on this observable information should decrease the propensity of community leaders to disseminate significantly incorrect information. This knowledge must also be accompanied by building the capacity and reliability of information sharing channels across CSOs, communities, and barangays in order to decrease the risks posed by asymmetrical information. CSOs should have a method of communicating with each other in order to share or corroborate alerts. In the event of a future Tail Dike breach, if community members in Bacolor received a text message from a non-CSO or Bacolor government source, they could ask their local CSO to corroborate the information. CSOs need to be able to contact someone in San Fernando (or the area in question) who has been trained in understanding the warning signs and can provide measurement and observation based information to confirm or dispel rumors. These networks across barangays were successfully developed and utilized during the lahar flows of the 1990s and have the potential to be revived and restored to cope with the recurrent flooding risks.

4.4 Strategy IV: Standardize the data inputs

With any effective warning system, it is imperative that the information being communicated is accurate to avoid panics such have been demonstrated previously in Bacolor (Philippines Information Agency, 2012). As funding becomes available, installing cost-effective monitoring and early-warning technology to monitor water level at specific points along the Gugu Creek should be made a priority. These systems can be connected to an automated siren which sounds as the water level crosses the warning mark. These systems have been successfully implemented within limited budgets elsewhere and have dramatically decreased casualties and damage (Piya and Khanal, 2012). Once these systems are installed, much burden will be removed from the barangay captains and local community members to make a decision about evacuation with limited data. Additionally, problems from dams breaching upstream of Bacolor can be detected earlier and residents can respond effectively.

Computer networks should also be installed to connect the municipal government with PAGASA and Project NOAH for real-time meteorological reports, thus increasing the amount of data on which to base evacuation decisions. The local government and CSOs could explore partnerships with local or international technology corporations including Smart, Talk n Text, Globe, Touch Mobile, Sun Cellular networks, and others to enhance access to accurate information.

Finally, direct lines of communication need to be re-established between the Bacolor Disaster Risk Reduction and Management Office and residents to exchange weather hazard speculations. Radios are a relatively low-cost tool which can quickly disseminate information to community leaders even if power lines fail (Commonwealth of Australia, 2009). Back-up warning systems utilizing cell phones and other methods of communication may be developed in addition to radio networks should funding allow.

4.5 Strategy V: Explore new funding streams

Many of the disaster management challenges Bacolor faces could be greatly reduced with increased investment in technology and trainings. While options for increasing the five percent allotment received from the national government for calamities remain limited, additional national and international organizations may provide funding to implement the above mentioned strategies. In particular, Bacolor CSOs who are partners of the government should explore external funding options for implementing the above strategies in their barangay and throughout Bacolor. Initial suggestions include, but are not limited to, the following:

i. Religious organizations including the Catholic Church
ii. Corporate partners including SMART, GLOBE, Sun, Texas Instruments, Philips, etc
iii. National government agencies
iv. International governments / Non-governmental Organizations (NGOs)
v. Kickstarter and similar grassroots fundraising organizations
vi. Local groups including Rotary Clubs, Home owner associations, and the Clark Freeport Zone.

5. Conclusion and recommendations

The study has ascertained the factors that affect inefficient information dissemination in Bacolor, Pampanga: non-maintenance and non-monitoring of emergency communication tools, delay of evacuation orders due to reliance on a single individual (Barangay Captain) to reach all residents in one barangay, lack of access to resources which provide accurate weather information and data, failure to distinguish between evacuation warnings for floods versus floods carrying lahar deposits, lack of

capacity development of residents, and severe funding and logistical constraints to invest in communication systems. The insufficiency of this current early warning information system has been clearly demonstrated during the response to the August 2012 monsoon floods.

In view of the findings presented, the following recommendations are made to improve information dissemination in Bacolor: (1) Decentralize communication and information networks incorporating non-government and civil society organizations, (2) Conduct extensive stakeholder engagement to mobilize people with local knowledge and resources, (3) Build the capacity of local community-based stakeholders to raise awareness of risk and vulnerability while steadily building autonomous capacity, (4) Standardize the data inputs to be able to communicate accurate information, and (5) Explore new funding streams to facilitate investments in technology and training.

Overall, successful implementation of the identified recommendations has shown positive results across regions of the Philippines and the world by increasing the effectiveness of information dissemination leading to decreased losses due to natural disasters. The strategies to achieve the recommendations take into account location specific information and the areas of greatest potential for Bacolor to improve the dynamics of information exchange for flood disaster planning. Once developed, this system can be used beyond flooding warnings as different alarms and scenarios are designed and communicated to help residents prepare for lahar, earthquakes, or other natural risks which may affect them. Ultimately, by engaging community stakeholders, the government of Bacolor can foster an even more resilient community who are aware not only of their risks, but their collective resources, and who will be better prepared to respond to threats, natural or man-made, in the future.

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Endnotes

[1] Based on discussions with Ms. Gloria Cruz, the Municipal Planning & Development Officer (MPDO), Bacolor Municipality, August 13th, 2012.
[2] Based on discussions with Ananais "Jun" Canlas, Vice-Mayor, Bacolor Municipality, August 13th, 2012.
[3] Based on discussions with Ananais "Jun" Canlas, Vice-Mayor, Bacolor Municipality, August 13th, 2012. He was the Mayor of Bacolor Municipality in 1991, when Mt. Pinatubo erupted.
[4] Based on discussions with Ms. Gloria Cruz, the Municipal Planning & Development Officer (MPDO), Bacolor Municipality, August 13th, 2012.
[5] The University of the Philippines has already had extensive involvement in Bacolor, including developing the Bacolor Comprehensive Rehabilitation Master Plan in response to the Mt. Pinatubo eruption.
[6] One possible resource researchers spoke to, is the Governor of Albay, who instituted a variety of practices to significantly improve Albay's early warning system effectiveness based on feedback received from citizens as to why they did not heed evacuation orders (Salceda, 2012).

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