Presented at the DLSU Research Congress 2015
De La Salle University, Manila, Philippines
March 2-4, 2015

# Community-based Disaster Risk Reduction Management For the Municipality of Pila

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**Abstract:** The proponents created a web-based community-based disaster risk reduction management system, specifically for the municipality of Pila. The said system aims to provide information to the local authorities to help them formulate mitigation and preparedness plans for flooding incidents through processing collected data such as past disasters' data, community information and existing resources. The system displays the information through mapping technologies, document reports and other tools.

With the new system in place, officials can be able to access information on different disaster preparedness and mitigation aspects in the municipality. They are able to assess the hazards (floods), vulnerabilities (community), and monitor resources, among others. They can systematically collect and analyze the information for decision making. They no longer need to look for the data that may or may not be available due to change in leadership and data-owning. They now have data on the community. They know what vulnerabilities are present in the community and can plan accordingly. They can tailor fit their plans for their community.

The municipality can now easily maximize the disaster related information in identifying mitigation and preparedness measures with the new system. Everything is laid out in tables, charts and graphs. They no longer need to look at different inconsistent reports and places to have a holistic understanding of the situation. They no longer need to consolidate information themselves. They can just access the already consolidated information accessible in the system.

The system will also function as a centralized channel for the municipality to post and view events that will occur in the municipality. The community will no longer rely on word of mouth as much. They may access all the information on events involving disaster mitigation and preparedness through the system. The community may also send their feedbacks and suggestions through the system.

**Key Words:** Disaster Risk Reduction Management System

# 1. INTRODUCTION

## *1.1 Municipality of Pila*

Pila is a third class municipality in the province of Laguna that is comprised of 17 barangays. Four of those barangays are part of the poblacion. As of 2010, the municipality had a population of 46,534. Since Pila only has an area of 31.20 km$^2$, it has a population density of 1,500/ km$^2$. It is a very densely populated area compared to the national average population density of 312.

Pila is geographically located adjacent to Laguna de Bay and the foot of the mountainous areas of Nagcarlan and Magdalena. Unlike some of its neighboring municipalities, Pila is low, plain land that has an extremely high risk of flooding. Pila also has an extremely high chance of being hit by a cyclone which increases the risk of flooding in the area. Since Pila is located at the foot of Mount Banahaw, some barangays are exposed to landslides.

During the flooding due to Habagat last year, 5 out of 17 barangays experienced flooding. An estimate of Php 19,000,000 worth of agriculture damage had been caused by the flooding. Also during the flooding, 3,100 families were affected while 543 of those families were displaced. The flooding was experienced by the community by at least 3 months.

After several disasters were experienced by the country, the national government mandated each local government unit to have an office specialized for disaster reduction. Currently, the municipality of Pila has its Municipality Disaster Risk Reduction Management Office (MDRRMO) to handle disaster risk reduction activities. MDRRMO aims to reduce risk of the community through implementing mitigations measures and preparing the community for upcoming threats.

## *1.2 Problem Statement*

Risk assessment is done with experience and mere estimates. They do not have a systematic way of assessing risks. They do not utilize certain metrics and formulas for a systematic risk assessment. For them to do this, they first need to acquire the necessary data systematically as well, which they do not.

Due to the non-systematic way of collecting and analyzing of risk, mitigation and preparedness plans created are merely based on personal ideas of the local authorities. Information about the risk is not translated to an appropriate mitigation and preparedness plan.

Information dissemination is also a problem. Information about training events, drills, seminars, meetings and the like do not reach the people intended. People that want to volunteer or contribute ideas in meetings about planning for mitigation and preparedness cannot because the information on when or where meetings are held do not reach them. The information about this merely travels through the officials and the people they come in contact with.

As for the feedback of the implemented activities, feedbacks are collected and used for planning. Feedback may remain in the memory of the local authorities but not recorded and analyzed systematically.

## *1.3 Conceptual Framework*

The proponents created a Community-based Disaster Risk Reduction Management System for the Municipality of Pila. The said system aims to resolve the problems identified by the group. These problems are the following: Hazards, vulnerabilities, capacities and useful information about disaster are not systematically collected and analyzed; and information is not disseminated properly. Some information does not reach all people in the community.

The web application will be a PHP web application. PHP is the chosen language, to reduce the development cost of the system. The IDE used is Eclipse while the database server is MySQL.

### *1.3.1 Risk Assessment*

Risk assessment mainly deals with the input of data with regards to community vulnerability, historical data and hazard assessment. Through these inputs, the system will be able to generate maps, calendar or chronological visualizations, situation models, and reports. Officials are provided these visualizations, models and reports for them to make better decisions when planning for activities. They are able to make decisions that are more relevant to the community effectively.

#### *1.3.1.1 Data Gathering*

The system is capable of storing information such as historical data of disasters, information about residents, structures inside the community, equipment owned by the community and practices

done by the community related to disasters.

As for the disaster historical data, the local authorities can encode the information about the disaster such as date, areas affected, duration, speed of onset, flood depth, recorded water level, amount of rainfall and warning/s raised. The local authorities will encode the following information using the web application. The information will be stored in the database and can be shown as list, reports or can be used by other modules.

As for the resident information, the local authorities can encode the data through the web application. The local authorities can encode resident information such as name, age, address, gender, health status, livelihood, average income, number of people in the same household, house built, soil type and other information about the person or house. The information will be stored on the system's database. Information stored can be presented into lists and reports and will also be used in other modules.

Structures and equipment used by the community will also be encoded in the system. The local authorities will encode the information about the structure and equipment such as name, location, status, sources and evaluation about the equipment (durability, availability, capability).

### *1.3.1.2 Hazard Mapping and Calendaring*

Using the information stored in the systems' database, the system can visualize historical disaster information through map and calendar. The map will display information based on the characteristics of the hazards.

## 2. PROPOSED SOLUTION

The system will now take in information about direct rainfall and discharge rate of tributary rivers because these are the main causes of the water level rising. This information will come from PAGASA and external LGUs respectively. The current water level will also come from the LLDA. As for the vulnerabilities, the residents will provide their information for the municipality to have a holistic understanding of their residents. Local officials will be able to view the vulnerability map, the situation model (simulation), as well as the hazard map. To get a situation model, the local official must input simulation values for discharge rates of the tributary rivers as well as rainfall with hourly intervals for the system to produce a model that can show information such as hourly affected areas and people and how much relief goods will be needed.

### *2.1 System Description*

The system "The Ark Project" is a community-based system designed to collect, process, and most importantly provide information to barangay officials for effective & efficient planning of preparedness and mitigation activities for the municipality of Pila. The system will have a systematic approach to provide accurate and valuable information through maps, tables, charts, graphs, and reports. With this information the barangay officials may be able to plan more specific and aligned preparedness and mitigation activities.

The system has the following users: Barangay Officials, Administrators, and the Residents.

Barangay Officials, who are the different officials of each barangay in the municipality of Pila, have the following functions and capabilities:

Dashboard
- View Water Level
- Update Discharge Rate
- Update Direct Rainfall
- View Recommendations

Community
- Add House
- Add Resident
- Update Household
- View Map
- View Demographics

Flood
- Record Tributary River Discharge
- Simulate Flood
- View Flood Map
- View Flood Statistics

Resources
- Add Structure
- Add Equipment
- Add Relief Good
- Update Structure Status
- Update Equipment (Status & Location)
- Update Inventory
- View Resource Map

Events
- Add Event
- Update Event
- Evaluate Event
- View Event

System Administrators have the following capabilities:

- Full access to all features and functions
- Add user

Residents, who are the people who reside in the municipality of Pila, have the following capabilities:

Events
- Evaluate Event
- View Event
- View announcements

## 3. SCOPE

### *3.1 Hazard Mapping*

Information about the hazard or floods will be mapped. This will involve historical data of past floods. If there is ample data of hourly water levels, the system can also produce what areas are affected on an hourly basis. Historical data of floods will also be used to detect patterns, if there are any, and predict when floods occur during the year.

### *3.2 Vulnerability Mapping*

The vulnerabilities and the people will be mapped and information about them will be recorded in the system. The system will highlight special needs or disabilities. With this information, the municipal officials can plan mitigation and preparedness activities accordingly. They can have more trainings for the blind, for example, and have more notification and navigation aids for them during critical times. With the information about the people, planning of relief goods and evacuation centers will be more relevant.

### *3.3 Situation Modeling*

The situation modeling will provide the officials a simulation on how the flood will progress. Officials input simulation values of the discharge rates of the Laguna de Bay tributary rivers and direct rainfall, which are the main causes for water level rise. These rates are entered by hourly intervals. With this information the time for floods to affect each area in the municipality can be simulated for officials to prepare more relative and effective mitigation and preparedness plans.

### *3.4 Resource Tracking and Modeling*

Resources such as equipment, structures and relief goods will be tracked. The equipment will be prepared and ensured that they will be operational in critical times. Structures such as hospitals, pharmacies, supermarkets, and potential evacuation centers will also be mapped and ensured that they will be operational when needed. Relief goods are mostly not stored by the municipality; these are partitioned by supermarkets in case of disasters so they can still be maximized when not needed by selling them. The local government also does not spend for the storing of the goods. With the community information at hand, predicting the needed relief goods for certain magnitudes of floods for certain times of the floods will be more relevant.

### *3.5 Mitigation and Preparedness Event Management*

With the newly available information for the officials, they will be able to create more relevant and effective events and activities for the municipality. All public events will be posted on the public side of the system for residents to view. These events will be evaluated as well for improvement for future events.

## 4. FEASIBILITY

### *4.1 Operational Feasibility*

The system is designed with visual cues, effective use of color, adhering to design standards, well thought of overall process and has a cross between functionality and aesthetics. The learning curve for the system is smooth allowing less training time for system use. The users are also enthusiastic for using the system.

### *4.2 Technical Feasibility*

Each barangay in the municipality of Pila is equipped with at least the minimum requirements to operate the system. These minimum requirements include one computer with internet connection for each barangay and one dedicated computer in the municipal hall to serve as the server for the system.

### *4.3 Economic Feasibility*

The process of creating and implementing plans by the municipality of Pila with regards to preparedness and mitigation activities will be more cost-effective. Activities will be more aligned and information dissemination will be more effective reducing cost drastically. The system will have periodic maintenance costs and will incur some operational costs. All tools and implementation software and database used are free. Training of users will incur fees as well. Operational costs will exist through powering the server and computers and connecting them to the internet. Development fees are free. With all these, economic feasibility should be extremely in favor of the municipality and ultimately the mitigation and preparedness of the municipality.

## 5. CONCLUSION

With the new system in place, officials are now able to access information on different disaster preparedness and mitigation aspects in the municipality. They are able to assess the hazards (floods), vulnerabilities (community), and monitor resources among others.

With the new system, they can now systematically collect and analyze the information for decision making. They now have easy access to historical flood data. They no longer need to look for the data that may or may not be available due to change in leadership and data-owning. They now have data on the community. They know what vulnerabilities are present in the community and can plan accordingly. They can tailor fit their plans for their community.

The municipality can now easily maximize the disaster related information in identifying mitigation and preparedness measures with the new system. Everything is laid out in tables, charts and graphs. They no longer need to look at different inconsistent reports and places to have a holistic understanding of the situation. They no longer need to consolidate information themselves. They can just access the already consolidated information accessible in the system.

The system will also function as a centralized channel for the municipality to post and view events that will occur in the municipality. The community will no longer rely on word of mouth as much. They can just access all the information on events involving disaster mitigation and preparedness through the system. The community may also send their feedbacks and suggestions after the events through the system as well.

Now with community profiling, community planning, resource monitoring, hazard assessment and vulnerability assessment, officials may now create plans more productively. They may now focus more on creating relevant and effective mitigation and preparedness efforts rather than worrying about consolidating the data from different sources. Officials may also produce simulation scenarios that can further show what would happen if such flood were to happen and how much resources will be needed per time interval. With this, they can adjust accordingly.

The main objective of the study has been addressed. The system significantly improved the community's mitigation and preparedness planning efforts. This was done through making the process of data collection and analysis systematic. Collected information is maximized. A centralized channel for event awareness is now easily accessible. And officials may now produce simulations of floods. All of this is for the officials to produce more effective and relevant plans for the municipality.

## 6. RECOMMENDATION

The proponents propose several possible other information systems or modules to compliment the mitigation and preparedness system proposed.

One direct complimentary system would be a response and recovery disaster management system. This would focus more on during and post-disaster situations. This could handle the response and rescue for the people. It could also handle the holistic recovery of the people as well as have their livelihood and normal or even better overall lifestyle. The system could also implement concepts for child-friendly spaces in relief centers and gender-sensitive issues or roles during the whole post-disaster situation. The system could also produce the actual reports of the resources used and the affected people to cross reference it with the predictions of the mitigation and preparedness system to either compare or even adjust the system for future reference.

Another complementary system would be a system dedicated to evaluating the capacity of the community. It is the only seeming incalculable factor in the system. This means the system cannot take in

an objective increase or decrease in the capacity of the community. Capacity increase may involve equipment available, trainings the community has undergone, or whatever structural developments are made. Capacity decrease when structures are destroyed or equipment are not operational, for example. This system should include extensive research or even interdisciplinary studies with psychology or education.

Another recommendation would be an information system dedicated for planning and proposal processing. The mitigation and preparedness system end by providing officials the information they need in making plans and proposals. Currently, this proposal is put into writing and all the documents are attached to it and submitted to the head for evaluation and approval. The recommended system may carry over information from the system and perhaps make recommended action plans subject to the information presented. The officials may just select which action plans they want to implement and the system can suggest dates for these activities. After everything has been selected and planned out by the official, the system may either produce printouts of the plans together with all the supporting documents or just have everything laid out on a web app of some sort ready for the head to view, make minor changes or recommendations and approve. These plans may then automatically proceed to implementation and have everything scheduled and planned out. Officials may just access these approved dates for reference.

## 7. REFERENCES

Abarquez, I., & Murshed, Z. (2004). Community-based Disaster Risk Management for Local Authorities. Bangkok: Asian Development Preparedness Center.

Crisostomo, R. P. (2007, May 8 ). “From Victims to Survivors”. Retrieved from http://www.jica.go.jp/english/news/jbic_archive/autocontents/english/news/2007/ 000070/05.pdf

Galing Pook . (2005). Infanta Community Based Disaster Management. Infanta, Quezon, Philippines.

International Strategy for Risk Reduction. (2005, January 18-25). Brief history of the WCDR Process. Retrieved from World Conference on Disaster Reduction: http://www.unisdr.org/2005/wcdr/intergover/official-doc/L-docs/Hyogo- declaration-english.pdf

Kafle, S., & Murshed, Z. (2006). Community-Based Disaster Risk Management for Local Authorities. Bangkok: Asian Development Preparedness Center.

Mercado, E. (2008, September). A Case Study of the Municipality of Infanta, Quezon Province Community-based Disaster Preparedness and Management. Retrieved from http://siteresources.worldbank.org/INTPHILIPPINES/Resources/ElmerMercado WBCEACaseStudyInfanta.pdf

Virtual University for Small States of Commonwealth. (2007). Introduction to Disaster Management . Vancouver: Virtual University for Small States of Commonwealth.