Developing a Framework on Predicting Evacuee Needs for Disaster Risk Reduction Management in the Province of Albay

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Abstract. An evacuee needs allocation framework wants to ease the predicting process on disaster preparedness in the province of Albay. The evacuee needs allocation framework will help the provincial government to identify and solve the problem of the current and manual process of the disaster management system in preparation down to the allocation of evacuee needs. An evacuation centre is a place that the Provincial Government provides basic human needs including food, water as well as accommodation during or before the disasters to the affected people. Detailed assessment was conducted by authorized personnel in the government organization to look at how to improve the chances of disaster victims with their stay in an evacuation centre. In this paper, the study aims to develop a framework that predicts the evacuee needs preparedness as well as the allocation needs on before and during the calamity to help and enhance the current process in the province of Albay. The researcher includes information technology tools such as RFID and GPS to the framework to enhance the efficiency and accuracy in the implementation of the needs allocation during the calamity in the evacuation centres. The paper will lead the provincial government of Albay in predicting the evacuee needs to insure a sufficient and avoid the shortage and excess of goods from the preparation down to the allocation in the evacuation centres and to help the Provincial Disaster Risk Reduction Management Council in allocating and monitoring of budgets for transparency purposes.

1. Introduction

Developing a framework on Predicting Evacuee needs wants to address that disaster has evolved through time into a complex policy subsystem, and disaster policy is enforced through a collection of functions referred as emergency management and response. In the modern technology, approaches in the disaster management involves its multidimensional efforts to reduce the vulnerability to hazards; to limit the effects of disasters; and to arrange for, respond to, and recover from the disaster occur.

Disaster readiness refers to do things or accomplish a purpose to get ready and lessen the effects of disasters. In the 2018 information of World Risk Report, the Philippines rank third among all of the nations worldwide which has very high in disaster risk, with index value of 25.14% [1]. The nation’s total area of at least 60% is vulnerable to multiple threats or dangers, and 74% of the population is vulnerable to their impact [2]. The risk including coastal threats such as typhoons, tsunami and rising sea level is due to the location and geographical context of the country. Also, since the island is located within the “Ring of Fire” the people are seriously exposed to earthquakes and volcanic
eruptions, flooding, landslides, droughts and tsunamis that further contribute to the exposure of natural disasters [3]. Hydro-meteorological events together with typhoons and floods, accounted for over 80% of the natural disasters within the country throughout the year [4]. Some of the region’s most affected by natural disasters in the Philippines are Bohol, Eastern Visayas, Bicol and Ilocos [5][6].

Albay is a Philippine region situated in Bicol about 500 kilometres south of Manila. In 2015, the population of the province pegged at 1,314,826, with the weight of 481 people for each square kilometre. The province is considered as one of the most disaster-prone areas in the country because of its area, geography and land. However, the provincial government mostly managed to stay its zero-casualty goals throughout disasters. The Provincial Government of Albay hailed by many International Organizations because of its highly effective Disaster Risk Response and Management.

The National Risk Reduction and Management Plan (NDRRMP) accomplish the necessity of RA No. 10121 of 2010, which come up of the legitimate reason for policies, plans and projects to manage calamities. The NDRRMP incorporates four topical zones like as Disaster Interference and Mitigation; Disaster Preparedness; Disaster reaction; and Disaster restoration and Recovery that adjust to the structure of the National Disaster Risk Reduction and Management Council (NDRRMC) [7]. Evacuation management is one among the previous plans in disaster interference and preparation to avoid wasting life in every disaster.

Evacuation is a risk management technique that might be utilized to decrease death toll or reduce the impacts of a crisis on a network, before the beginning of, or during, a crisis. It includes the development of individuals compromised by a risk to a more secure area and, normally, their possible sheltered and timely return. For an evacuation to be as effective as could be expected under the circumstances, it must be appropriately arranged and implemented. Depending on the risk and its effect on the network, the clearing procedure, including withdrawal and return, may take days, weeks or months to finish. Some evacuations might be completed rapidly and over short distances [8].

Disaster Risk Reduction Management is an investment, not an expense and it increases the business returns. The province of Albay has seen an expansion of ventures, even when there are calamities such as typhoons and volcanic eruptions. Climate change transformation and risk reduction management permit advancement to continue in the midst of disasters, since the provincial government takes responsibility of the disaster and they don’t disrupt the lives of their subordinates [9][10][11][12].

Thus, the study aims to develop a Framework on Predicting Evacuee Needs Allocation for Disaster Preparedness in the Province of Albay to allow and understand the situation, make a connection and interact with the government agencies in the preparation and implementation of needs allocation in every disaster or calamity. Also, the framework wants to lessen the time in the implementation of needs allocation during the calamity and to lessen the time in preparing the report for the annual DRRM Evacuation needs budget. Making predictions is a valuable strategy to improve the decisions for DRRM Planning and implementation.

2. Review of related literature

2.1. The 2011-2028 Philippines National Disaster Risk Reduction and Management Plan (PNDRRMP)

The Philippine National DRRM Framework fills in as the principal manual to the disaster risk reduction and management endeavours to the nation. The Framework envisions a country of a safer, flexible and disaster versatile Filipino people group toward maintainable turn of events. It grants a paradigm change from responsive to proactive DRRM whereby people have expanded their mindfulness and comprehension of DRRM. The NDRRMP sets the sets the normal results, outputs, key activities, markers, lead offices, executing accomplices and timelines under each of the four particular yet commonly strengthening topical regions. The goals of every thematic space result in the fulfilment of the nation's general DRRM vision [13].

2.2. International Frameworks for Disaster Risk Reduction (DRR)
The National Disaster Risk Management Framework (NDRMF) of Palau plots an institutional structure to ensure successful coordination and cooperation in preparing for and reacting to, property moderation against and recuperation from the effect of hazards that proportion of high danger to Palau. The Framework likewise accommodates powerful coordination and direction for leaders in the improvement of crisis reaction plans and techniques and calamity hazard decrease systems by government and non-government offices that have commanded obligations regarding such exercises.

[14][21].

Figure 1. Philippines National Disaster Risk Reduction and Management Plan

Another Disaster Risk Reduction (DRR) framework is the Sendai Framework (2015-2030), it plots the seven clear targets and four requirements for activity to prevent new and decrease existing calamity dangers, for example, understanding calamity hazard; fortifying calamity hazard administration to manage disaster hazard; Investing in disaster reduction for flexibility and; Enhancing disaster readiness for practical response, and to Build Back Better in recovery and reproduction. It intends to achieve the generous decrease of calamity threat and losses in lives, livelihoods and well-being and in the budgetary, physical, social, social and ecological assets of people, associations, organizations and countries throughout the following 15 years. The Framework was embraced at the Third United Nation World Conference on Disaster Risk Reduction in Sendai, Japan, on March 18, 2015 [11][12][15].

Figure 2. Palau Disaster Risk Reduction and Management Model
2.3. Information Technology tools Framework
Radio frequency identification (RFID) is a remote correspondence technology that facilitates automatic identification and data capture without human intervention. It has the advantage of having the option to catch data without the requirement for the distinguishing proof module and the probe to be in the line of sight. (Gupta et al., 2015), Automated care and safety design is accomplished utilizing RFID. From the perspective of workflow management, several manual works like the determination of patient discharge time, reservation for regular check-up can be achievable through automation. RFID tags guarantee exact information collection with minimal human intervention [16].

![Figure 3. Function of RFID Technology](image)

GPS data provides latitude, longitude, and time – three variables that enable us to assess when an individual is found wherever. Data are collected at varied intervals ranging from each few hours. In the study of Jankowska et al., they conferred a framework for integration of GPS, GIS, and accelerometer data, as well as information collection concerns, attainable data outputs from joining specific technologies, and analytical methods when using all three measurement ways along. The framework is supposed to guide researchers through abstract development of GPS based mostly PA and SB comes by deepening the understanding of what info represents, the categories of research questions that are and aren’t attainable to answer with the data, how to combine datasets to create better representations of human-environment interactions, and therefore the details for information

![Figure 4. Framework for integration of GPS, accelerometer, and GIS technology](image)
assortment, handling, and analysis that has to be considered to make sure successful productive project completion [17].

2.4. Predictive Algorithm
Predictive Analytics (PA) tools are presented by few distinctive pattern or paradigm and algorithms which is able to apply in a wide scope of utilization instances. The top 5 predictive Analytics models are classification model, clustering model, forecast model, outliers model, and the time series model. The key in obtaining the best out of a predictive analytics answer and support information to create perspective choice is to determine what predictive model are fitted for the organization. The PA algorithms are mostly divided into two groups, the Machine Learning (ML) and the Deep Learning (DL). The ML predictive modelling has several different algorithms that can be enforced. Majority of the frequent algorithms that are being utilized to influence the predictive analytics such as the Random Forest (RF), the Generalized Linear Model (GLM), the K-means and the Prophet algorithm. The first algorithm is the RF algorithm, it is the most utilized and preferred classification rule that is capable of classification and regression. An RF accurately classifies a huge volume of data. Second, the GLM may be an additional complicated version of the General Linear Model. It takes the latter model’s comparison of the results of multiple variables on continuous variables before drawing from array of varied distributions to look out the best fit model. Another algorithm is the K-means algorithm; it may be a widespread and fast algorithm that includes putting unlabelled data points in different groups based on correspondence. The algorithm is also employed for the clustering model. And last the Prophet algorithm; it is an open-source algorithm developed by Facebook Company to utilize in the time series and forecasting model. It is utilized internally for forecasting an open-source algorithm developed by Facebook, used internally by the company for forecasting [18].

3. Methodology
A combination of data analysis and interview were applied for data collection. Mr. Andes, the former Local Disaster Risk Reduction Management Council (LDRRMC) officer and Ms. Siwa the coordinator of Municipal Social Welfare and Development Office were interviewed about the policies and procedure of needs assessment and allocation for pre and during the disaster. They provided an adequate amount of information on how the framework can be develop by giving some requirements and the possible agencies that can be use its benefits. The researchers used a Document Analysis in able to know the duties and responsibilities of government sectors that are connected in the evacuee needs management of every municipality in the province of Albay. Public government files were also used in knowing the responsibilities of each sector related to evacuation and its importance to the community.

The conceptual Framework was designed by considering the issues encountered by the Local Government Unit, Barangay, MSWD, Evacuee and the DRRM council. GPS and RFID were also considered in the design of the evacuee needs allocation framework. Also, it considers the algorithm and predicting needs preparation and allocation.

4. Results and Findings
4.1. Standard allocated evacuee needs per household
Table 1 show the standard relief package distributed by the Department of Social Welfare and Development (DSWD). The average family food pack provided by the DSWD to the victims of calamity contains six (6) kilos of rice, eight sachets of coffee, eight (8) packs of instant noodles, and six (6) canned goods (three (3) sardines, and three (3) corned beef). It is meant to last a family of five (5) for two (2) to three (3) days. The DSWD has introduced new relief packages being distributed to affected families. The said relief goods is good for a family of five (5) for two (2) days. It should be sealed when distributed [19].
### Table 1. Evacuee Relief Goods Allocation.

| Needs Description | Amount/Qty |
|-------------------|------------|
| Rice              | 6 kg       |
| Coffee/Cereal Drink | 6 sachet  |
| Corned Beef       | 4 tin      |
| Sardines          | 4 tin      |

#### 4.2. Pre-emptive Evacuation Management

The Barangay person in-charge identifies the families who are in need during the hazard/calamity and create a Risk Analysis of Population report according to the type of hazard/calamity and submit it to the Municipal DRRM. The Municipal DRRM person in-charge identifies the pre-needs of the reported resident for evacuee planning. It also prepares a pre-emptive evacuation report based on the information submitted by the Barangay DRRM. The MSWD person in-charge receive the pre-emptive evacuation report contains of the total family members by type of hazard. The Barangay person in-charge provides the total list of resident at risk in every Barangay according to hazard. The Municipal DRRM person in-charge summarizes the total evacuee according to age and gender per hazard or calamity. The MSWD person in-charge will identify the list family risk to calamity or hazard and target evacuation center [20].

#### 4.3. Factors influencing in the design of digital evacuee needs management

In mid 2013, the Department of Social Welfare and Development (DSWD) wound up trapped in an extremely twirl of debates identifying with the repacking and conveyance of alleviation stock. A few news organizations supposed that help stock from land were repacked utilizing DSWD’s legitimate packs. There was conjointly a Commission on Audit (COA) report expressing that 7,527 family food bundles estimation of Php 2,784,900,19, 172 canned merchandise, 81 packs of noodles, 21 sacks of rice, in addition to the 76,300 different canned products were not reasonable for human utilization because of "inappropriate handling" [22].

#### 4.4. The Proposed Evacuee Needs Management Framework

The figure shows the proposed Evacuee needs allocation framework for the province of Albay. This framework has direct linkages to the Local Government Agencies that concerns the Evacuations Needs Management. The Evacuee needs allocation system has 3 major key roles such as the BDRRMC, MDRRMC and the MSWD. It also shows the function of an RFID and GPS devices that helps the local government in monitoring the evacuee needs distribution during the calamity.

The role of the Barangay Disaster Risk Reduction Management Council (BDRRMC) is to collect the information from the residents who are at risk in calamity/disaster such as flood, typhoon, earthquake, landslide and tsunami. The BDRRMC are the in-charge in identifying who are at risk in every Barangay. The officer in-charge will encode the information conducted from every Barangay to the computerized system.

The role of the Municipal Disaster Risk Reduction Management Council is to consolidate all the information (residents who are at risk) taken from the Barangay covered by the municipality. The municipal office will generate a pre-emptive report based on the submitted information by the BDRRMC. The council may use the computerized system in a decision making in generating the Annual Disaster Risk Reduction Management budget for the needs allocation in the evacuation centers.

The role of Provincial Risk Reduction Management Council is to monitor and support the needs of every municipality. The PDRRMC office will monitor the distribution of needs in all the evacuations
centers. The council may generate a statistical graph of the needs allocation using the proposed computerized system.

![Figure 5. Framework for predicting Evacuee needs allocation for Disaster Preparedness](image)

The role of Municipal Social Welfare Development is to generate a generated report submitted by the MDRRM. The report will be posted electronically and will access in the proposed computerized system. During the calamity, the officer in-charge in every evacuation centre will verify the information of evacuee through the use of Evacuee ID (integrated RFID) for a fast allocation of needs.

The GPS device refers to automatic monitoring of activities in the evacuation center. The GPS will be attached in the computing machine (Computer or laptop) of the officer in charge in the allocation of needs in the center. The MDRRMC can verify the actual GPS location of the machine to the data encoded to the computerized system. All the information will be send to the office of MSWD and MDRRC that the needs are allocated properly.

The RFID device refers to minimizing or lessening the multiple inputs of evacuees in monitoring the casualties during the disaster. Every Evacuee Family head will be given an Evacuee ID with integrated RFID. The Evacuee ID will be use in monitoring the attendance of each family and family member in the evacuation centers. Also, the ID will use in an accurate monitoring and allocating of needs in the centers.

The predictive k-means algorithm is a machine learning technique that will be applied in the proposed system. It will give an automatic prediction of needs allocation for the next planning of Disaster Risk Reduction Management budget in every municipality for the next year and it will lessen the time in preparing of reports.

4.5. The Findings

On the framework and data presented, the GPS and RFID digitals tools will help the monitoring of evacuees and needs allocated during the calamity. The use Evacuee ID with integrated RFID will help the DRRM to monitor the accurate distribution of needs in the evacuation centers and by the use of GPS technology the local government unit can easily monitor the location of distributed goods. The k-means predictive algorithm will help the Provincial DRRM to easily predict the evacuee needs for the pre-emptive report of DRRM in the DRRM planning for the next Calendar year.
5. Conclusion
The researchers have presented the Evacuee needs management framework of the study. The Framework will guide to the Provincial Disaster Risk Reduction Management (PDRRM) to enhance the process of the preparation and allocation of needs in the province of Albay. Using the RFID attached in the Evacuee ID, the LGU will easily monitor the distribution and Evacuee information of the Province.

The researchers recommend developing the evacuee needs management system to implement and lessen the process of allocation of evacuee needs in every evacuation centers in every calamity. Also, recommends testing of the usability to check its accuracy and efficiency of the system with algorithm used in the prediction.

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