

# A Comparative study of Economic Sectors' Typhoon Resiliency in Barangay Bangad, Talim, Binangonan, Rizal, Philippines

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**Abstract**--Disaster resiliency has caught more attention as Disaster Risk Reduction Management (DRRM) programs have had a wide spread throughout the country. As climate change worsens, this paper seeks to study the differences of households' level of resiliency (ability to cope with the shocks and stresses of typhoons) with reference to their different livelihoods and sources of income. The factors considered in the study composes of the household's typhoon awareness, preparedness, and recovery. Results shows that, Barangay Bangad has an average of 71.73% level of awareness, 74.13% level of preparedness, and 73.64% level of overall resiliency from Typhoon Ondoy, Milenyo and Santi. It has been observed that Barangay Bangad's awareness, preparedness, level of recovery, and speed of recovery did not depend strongly on their socio-economic status which garnered a low positive correlation. Being an isolated and small community, barangay participation is evident in their area. It has become the prevalent external factor that has greatly affected the results. 84% of the respondents have also received external relief or aid that increased the speed of their recovery. The study features limited indices that contributes to the household's resiliency. The absence of a benchmark posed a challenge of comparing Barangay Bangad's household's level of resiliency with a widely accepted standard. For further reinforcement of the study, considering of additional indices and developing of benchmarking tools is highly recommended.

**Keywords**--- Resiliency, Preparedness, Awareness, Recovery, Disaster Risk Reduction Management

## I. INTRODUCTION

In recent years, the concept of resilience has gained attention recognizing the fact that not all threats or disasters can be averted. Indeed, societies are turning their attention to efforts and ways that can enhance the community resilience of entire communities against various types of extreme events.(Renschler et al., 2010)

The Philippines is one of the most disaster-prone countries in the world. Its location makes it vulnerable to a variety of natural disasters. Furthermore, social and economic conditions, such as low maintenance standards for disaster prevention facilities and problems with the poor living in damage-prone areas, contribute to an increase in their vulnerability to disasters. (Nakasu et al., 2011).

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In September 26 of 2009, Typhoon Ondoy (International Code Name:"Ketsana") battered the city of Manila, pouring a month's worth of rain in half a day. As the rains persisted, major roads and neighbourhoods were instantaneously flooded forcing people to scramble to higher grounds and structures. Media coverage of the typhoon vivified the terror of families on their rooftops as they desperately called for rescue, while other homes and cars were swept away by the deluge. Within hours, huge portions of Marikina, Pasig, Rizal and Quezon City became virtual extensions of rivers. In its wake, Typhoon Ondoy left 880,175 families severely affected, 682casualties (337 dead, 308 injured and 37 missing), and damaged infrastructure and agriculture amounting to PhP 10.5 billion (National Disaster Coordinating Council, 2009).

Flood risk management includes different types of objectives that aim to provide protection in a particular community. One of which can be the number of measures that can be adapted for safety purposes. In addition, these measures may also lead to a multi-layer safety in which introduces flood risk probability-reducing instruments in a sense that prior measures are being implemented to contribute to the community's flood risk management before, during and after a typhoon. Loss mitigating measures, on the other hand, establish protection system in terms of an individual's very existence, assets and properties. Developing multi-layer safety varies among countries wherein it depends on the level of priority, awareness and preparedness. In the case of Philippines in which it is classified as a developing country, limited resources is one common dilemma that affects the overall flood management plan as well as the measures specified above (Esteban et al., 2015).

On September 28, 2006, super typhoon Milenyo struck the Philippines that caused severe damages on different aspects of Filipino life. According to The Philippine Atmospheric, Geophysical, and Astronomical Services Administration (PAGASA), Milenyo had maximum sustained winds of 130 kilometers per hour and gusts of up to 160 kilometers per hour which can be considered as a deadly typhoon. Milenyo had its first land fall on Samar Island which eventually moved further north where Bicol region suffered greatly on this disaster. Following Bicol, CALABARZON region that includes provinces of Cavite, Laguna, Batangas, Rizal and Quezon had also accumulated a large amount of damages. Generally, typhoon Milenyo had indeed caused torment to the

lives of victims especially because their livelihood suffered which prevent them to recover immediately. Filipino households, on the other side, shouldered substantial amount of damages due to this disastrous event (Carnaje & Cabanilla, 2009).

Typhoon Mirinae or also called and known Typhoon Santi in the Philippines causes damages such as 39 people were killed and left roughly \$15.1 million in damage. According to PAGASA, Storm Santi intensified steadily, eventually becoming a Category 2 typhoon with peak winds of 105 mph (165 km/h). The eye of the typhoon was located at 145 km East Southeast of Baler, Aurora and has been forecasted moving West at 15kph. Typhoon Santi destroyed some of the agricultural areas of those living in the low-lying areas because of its strong winds. (Mallari, 2014).

This paper is limited to household level resiliency for this is where risk reduction and coping strategies are most evident and implemented (Alinovi et al., 2010). Regional, national, and global resiliency was not covered in the study. The household awareness and preparedness indices does not measure extensively government, LGU and other external factor's intervention in increasing the resiliency.

In this study, the researchers aim to explore typhoon resiliency of a certain community in which variables such as recovery, preparedness, awareness and socioeconomic status of every household are being taken into account. This research primarily targets to discover the relationship of household's physical, mental and economic condition with how subjects respond to typhoons. By measuring the recovery experienced by the subjects, resiliency will be determined with respect to their livelihood. In particular, occupations like furniture making, fishing, government employee, vendor and others, where residents usually fall will also be studied in terms of its impact to household's pre typhoon and post typhoon context.

## II. LITERATURE REVIEW

### 2.1 Literature Review

Resilience is the response to recover from shocks and stresses in a timely and effective manner (Rivera et al. (2015). This involves returning to equilibrium state through mitigation models, recovery and cognitive models (Tobin, 1999). Mitigation models are actions taken to decrease risk. Recovery is the response after the disaster while cognitive models focus on the level of awareness or knowledgeability of a person.

According to Maguire and Hagan (2007), resilient communities undergo four disaster management phases: mitigation, disaster preparedness, response, and recovery. Mitigation is defined to be actions that are taken before a disaster to reduce vulnerability. Disaster Preparedness, on the other hand, are actions taken before disaster impact that enable social units to respond when the disaster strikes. Disaster response are actions done before and during the disaster impact to reduce damages. Lastly, disaster recovery are actions taken to restore disrupted routines and economics

activities. With the growing popularity of the Hyogo framework, awareness was identified as one challenge to risk reduction management.

This study has utilized the household's awareness, preparedness and recovery as factors of resiliency. Differences in livelihood are quantified through their socio-economic status. According to Israel and Briones (2014). Most poor households will be more likely to practice more informal livelihoods while rich households are more likely to practice alternative livelihoods. Livelihoods in this study observed are the following: Furniture and BBQ stick making, Fisheries, Vendors of sari-sari stores, Government employees and others.

### 2.2 Research Question/s (or Hypotheses)

The household's level of awareness, preparedness and recovery will vary accordingly depending on their livelihood. In turn, these three variables are greatly related to socio-economic status. The measurement of correlation of their livelihood to the three factors of resiliency was measured through utilizing their socio-economic status as the quantitative variable.

## III. THE METHODOLOGY AND MODEL

### 3.1 Research Design: Descriptive – Correlational

#### 3.2 Meaning

A descriptive correlational research design will be utilized in this study to describe resiliency, preparedness, awareness and socioeconomic status of the target population and also, to examine the relationship between those variables. Descriptive research is a study design primarily used to observe and describe behavior of a subject without influencing it in any way. In other words, it is simply an attempt to determine, describe or identify the characteristics of a population or phenomenon being studied with researchers having no control over variables (Ethridge, 2004). In addition, the degree of problem definition in this design is partially defined wherein there is awareness with regards to the problem. The research approach is structured that follows a systematic process of reasoning. Survey, panel and scanner data are usually the methods for its data collection (Zikmund, et al., 2012). According to Fax and Bayat (2007), descriptive research is directed towards current issues and problems through a process of data collection that assists the researchers to characterize the situation more completely than when it was not utilized yet. Moreover, descriptive research allows the integration of qualitative and quantitative methods of data collection (Dudovskiy, 2016). This aid the researchers since a quantitative approach was followed in data gathering procedure however, it was assisted by some qualitative survey questions. Like for example, the researchers have included questions in the interview schedule to examine the socioeconomic status of every subject in the sample size.

On one hand, correlational study design investigates the possibility of relationships between or among variables and

how strongly these variables relate to one another. It is a specific type of non-experimental design that provides empirical evidence whether or not variables are or are not related. In this study, the variables being observed are resiliency, preparedness, awareness and socioeconomic status. The researchers aim to determine the correlation of resiliency to the other three variables in each prevalent occupation identified in the study namely, furniture, fisheries, vendor, government employee and others. Furthermore, this design does not imply causation but only contributes to a deeper understanding of the variables being studied and their relationships. Correlational is non-experiment simply because it does not involve manipulating the variables chosen to be examined. Correlational coefficient, on the other hand, is important determinant whether the variables are positively correlated, negatively correlated or no correlation. A value close to +1 shows a strong positive relationship while a value close to -1 implies strong negative relationship. A value near zero shows that the variables are uncorrelated. Later in this chapter, data analysis (See 3.6) will explain the results found in running this statistical tool to establish which type of correlation is best suited for the gathered data.

### 3.3 Subjects and Study Site

The study will be conducted at Barangay Bangad in Talim Island, under the municipality of Binangonan Rizal. Talim Island is known as the largest lake island in the Laguna de Bay, which is the largest lake in the Philippines ("Talim Island", 2016). The island has 24 barangays wherein 17 belongs to the town of Binangonan while 7 to Cardona. The researchers will only focus at Barangay Bangad as one of its scope and limitations. According to the Municipal Planning Development Office of Binangonan Rizal, heaviest rains in this province including Talim Island, usually occur in the months of July, August and September. Saguin (2016) mentioned in her study about the aquaculture in Laguna de bay that hazards such as typhoons and floods has been intrinsic to the development and course of this kind of livelihood. Given the fact that Talim Island constitutes a large part of Laguna de Bay being the center of this largest lake, it can be inferred that residents of this island are affected by typhoons having the same nature of occupation which is fishing. The researchers have only considered as one of the constraints the three major typhoons that the residents of the study site experienced for the past ten (10) years namely Typhoon Milenyo (2006), Typhoon Ondoy (2009) and Typhoon Santi (2013).

With the help of the local government of Barangay Bangad, the researchers have accessed the population statistics of the study site. The subject of this research will be based upon quantitative approach where a sample will be selected that will represent the study population. At 95% confidence level and confidence interval at 10, the researchers have computed a 73 sample size. Confidence level is usually expressed as a percentage that tells how often the true percentage of the population who would pick an answer lies within the confidence interval. Since the

researchers have decided to use 95% confidence level, it implies that there is a 95% certainty that the whole population answers would be within a specific range (Kumar, 2011). On the other hand, confidence interval is also called margin of error that refers to the range of values wherein there is a specified probability that the value of a parameter lies within it (Kumar, 2011). However, qualifiers will be taken into consideration. These qualifying questions allow the researchers to disqualify respondents who don't meet the study's targeting criteria (Siniscalco & Auriat, 2005). One of the qualifiers of this study is that only heads of the households will be considered to administer the data collection method given the nature of this research that targets to determine the economic resiliency of the study population. According to Development of National Statistical Systems, head of the household is defined as a married or unmarried person who maintains and support the household's financial needs.

### 3.4 Data Gathering Procedure

A structured interview will be used to gather primary data that will be supported by an interview schedule which contains both descriptive and quantitative questions. This is one of primary data collection methods that aim to obtain information from first hand sources that usually use to observe practical aspect of the study rather than its academic side (Currie, 2005). Furthermore, interview schedule is different from a questionnaire in a sense that the interviewer upon asking the respondent a question, will also be the one to record the respondent's replies on an interview schedule (Kamur, 2011). A simple random sampling will be used by the researchers to identify the respondents of the 73 computed sample size. Simple random sampling is the commonly used method of selecting a sample in which each element in the population has given an equal and independent chance of selection (Kamur, 2011).

The researchers proceeded to actual data gathering procedure where 73 households were administered for interviews with the guidance of secretary of Barangay Bangad. Each interview lasted for 5 – 15 minutes. Descriptive questions such as the socioeconomic status of the respondents were asked with an assurance of anonymity from the researchers. Likewise, quantitative questions utilized rating and Likert scales to measure the important variables in this study like preparedness, awareness and resiliency. However, only 30 respondents were qualified in the study based on the target criteria that the researchers had established. Data of qualified respondents were subject for data analysis.

### 3.5 Ethical Considerations

Ethical considerations in a research are crucial for it determines the acceptable and unacceptable behaviors, conduct and norms that the researchers must observe. These are important simply because the integrity, reliability and validity of the research findings rely heavily on the conformity of the study to ethical principles. In a quantitative

research, **prevention of fabrication or falsifying of data** has been one of the primary considerations in a research which aim to promote pursuit of knowledge and truth which the researchers have observed. **Voluntary participation** and **informed consent** are also being taken into account to render the study ethical. Voluntary participation or self-determination means that research candidates has the right to decide whether or not to participate in the study. It is therefore paramount that informed consent must be obtained before conducting the research wherein subject should be properly notify about the purpose of the study, data gathering procedure and an assurance that there is neither risk nor costs involve in the study (Resnik, 2010). Since this research uses primary data collection, Bryman and Bell (2007) have mentioned ethical principles that should be taken into consideration, which the researchers have followed, like **confidentiality** and **privacy** of research participants. This is an assurance that participant’s information will not be disclosed and procedures are in place to protect the data and names of the respondents. The authors have also mentioned that **affiliation in any forms, sources of funding** and **conflict of interests** of the researchers has to be declared. This ethical guideline has been critical to the study because respondents almost did not want to participate thinking that the researchers are associated to this certain government institution. Lastly, **scientific honesty** is perceived as the most important ethical responsibility when conducting a research (Bryman & Bell, 2007). This prevents the researchers from manipulating the data and maintains data integrity from the beginning until the end of this study.

3.6 Data Analysis

Using Microsoft Excel, the researchers computed for the correlation between the household’s socio-economic status and their level of awareness, preparedness and resiliency. These results have been further supported by the analysis of variance (ANOVA) of the different household’s awareness, preparedness and resiliency. Correlation was utilized to measure a possible relationship between variables. The analysis of variance then reinforces the findings that the level that there will be no significant difference between household’s awareness, preparedness and recovery despite their different economic sectors.

TABLE I  
CORRELATION OF SOCIO-ECONOMIC STATUS

Correlation of Variables	
socio econ and awareness	0.267391786
socio econ and preparedness	0.179416218
socio econ and level of recovery	0.120637996
socio econ and speed of recovery	0.405414864
socio econ and sum of recovery factors	0.457287331

The table above shows the correlation of socio-economic status to the household’s level of awareness, preparedness, recovery, speed of recovery and overall recovery.

TABLE II  
RESULTS OF ANOVA FOR THE AWARENESS OF DIFFERENT SECTORS

ANOVA	SS	df	MS	F	F crit
Source of Variation					
Between Groups	31.51905	4	7.879762	0.973543	2.75871
Within Groups	202.3476	25	8.093905		
Total	233.8667	29			

The table above shows the analysis of variance for the household’s level of awareness based on each of on their livelihood.

TABLE III  
RESULTS OF ANOVA FOR THE FOR THE PREPAREDNESS OF DIFFERENT SECTORS

ANOVA	SS	df	MS	F	F crit
Source of Variation					
Between Groups	7.666667	4	1.916667	0.303654	2.75871
Within Groups	157.8	25	6.312		
Total	165.4667	29			

The table above shows the analysis of variance for household’s level of preparedness based on their livelihood.

TABLE IV  
RESULTS OF ANOVA FOR THE FOR THE HOUSEHOLD RESILIENCY OF DIFFERENT SECTORS

ANOVA	SS	df	MS	F	F crit
Source of Variation					
Between Groups	22.01905	4	5.504762	1.290006	2.75871
Within Groups	106.681	25	4.267238		
Total	128.7	29			

The Table above shows the analysis of variance for the household’s resiliency based on their livelihoods.

IV. THE FINDINGS

Overall, the researchers’ findings have shown that there is a weak positive relationship between household’s socio-economic and the three factors: awareness, preparedness and recovery. This implies that the household’s level of awareness, preparedness and recovery does depend on their socio-economic status. Results show that about 7 out of 10 from furniture and BBQ stick making, fisheries, sari-sari store vendors, government employees, and other jobs are aware, prepared and able to recover.

Moreover, analysis of variance (ANOVA) results showed that the data obtained from the different households did not vary significantly. Researchers believe that it is due to the unique characteristics of the community. Two contributing factors were prevalent in their community namely: barangay participation and presence of relief or aid. Barangay Bangad, as a small isolated community, exhibited a high barangay participation. Resident’s claim that their government observably takes measures to prepare them for natural disasters such as holding seminars and disseminating

warning systems to households. Based on the survey, 7 out of 10 households affected by the typhoon were also able to receive relief or aid.

#### V. SUMMARY AND CONCLUSIONS

The researchers found out that there is a weak positive relationship between the variables and their socioeconomic status. Furthermore, the researchers also used analysis of variance (ANOVA) to test the consistency of the result which leads to a no significant relationship between all the variables. This result implies that government participation has made an important role in building the resiliency of the residents of barangay Bangad, Talim Island which makes it independent from their livelihood.

Also, due to the lack of benchmark the researchers had a difficult time in drawing the line whether a community which is resilient or not. The remedy that the researchers used is to use descriptive statistics particularly by using relative frequency table to get the percentage of awareness, preparedness and level of recovery with respect to the residents of Barangay Bangad. The results found out that 7 out of 10 residents are aware, prepared and able to recover. Overall, the community have an average level of preparedness, awareness and resiliency to the upcoming disasters in the said area. But the local government unit should and the area should have a more careful planning in the coming disaster, because there is still a portion of the community who is vulnerable to any unexpected catastrophe in the community.

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