EXAMINING THE RELATIONSHIP BETWEEN SOCIAL VULNERABILITY AND PROPERTY DAMAGE DUE TO CYCLONES IN YANGON CITY, MYANMAR

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1. Introduction

Social vulnerability is a product of social factors that influence the susceptibility of different groups and also affects their ability to prepare for, respond to, and recover from disasters. Researches also show that societal factors such as growing populations, increased wealth, and demographic shifts are partially responsible for increased loss and property damages during hazardous events. Myanmar, as a developing country, is further impeded from economic development due to its exposure to a range of fatal and destructive natural hazards such as cyclones. Cyclone Nargis in 2008, for example, caused more than 140,000 casualties and an estimated damage amounting to $12.9 billion USD.

Understanding the relationship between social vulnerability and property damage is essential to identify which factors affect the increase or decrease of losses. Results can be used to increase household disaster resilience and to develop more strategic and target-specific initiatives for disaster risk reduction. To this end, this study focused on examining social vulnerability indicators as determinants of property damage due to cyclones using Yangon City, Myanmar as the case study.

2. Methodology

2.1. Data source

The data used for this study is based on a household interview survey (HIS) conducted in 2012 by the Japan International Cooperation Agency (JICA) in partnership with the Yangon City Development Committee (YCDC) as part of the project "A Strategic Urban Development Plan of Greater Yangon." Survey items cover the basic socioeconomic characteristics, vital urban services, and assessment of current service levels in Yangon City. The total number of sampled households was 10,069 with sample rates of 1.0-1.2% in Yangon City and its adjoining townships. After eliminating responses with insufficient and/or incorrect data, a subsample of 6,250 households who have experienced loss and damages from previous cyclone disasters was considered for this research.

2.2. Selection and evaluation of indicators

Adapting social vulnerability as defined in the research of Cutter [1], ten (10) social vulnerability indicators were extracted from the survey each presumed to affect the intensity of property damage (Table 1). Indicators were selected based on previous literatures identifying socioeconomic disparities, physical status of the structure, and disaster readiness as some of the factors influencing property exposure and damage. These were then defined and ascertained a criterion to determine how it contributes to the household's vulnerability.

Table 1 Social vulnerability indicators

Factor	Indicator	Variable name	Vulnerability criteria
Socio-economic characteristics	Ethnicity	ETH	Non-majority
	Income	INC	Low-income status
	Education level	EDLEV	Lower education
	Gender ratio	GENRAT	Women
	Age ratio	AGERAT	Elderly and children
	Employment ratio	EMPRAT	Financially dependent members
State of housing	Housing quality	HQLT	Temporary housing
	Housing condition	HCON	Poor condition
Disaster readiness	Disaster education	DISED	No disaster preparedness education
	Disaster preparation	DISPREP	No disaster preparations such as food, batteries, etc.

2.3. Evaluation of property damage

Respondents who experienced cyclone scaled the intensity of property damage they experienced from none, slight, serious to very serious. Only 12% of the population experienced very serious damages while majority experienced serious (33%) or slight (36%) damages. The remaining 19% of the households reported no property damages after the cyclone. The geospatial distribution of these results are presented on Figure 1. Findings show that there are no apparent pattern on the distribution of the households.

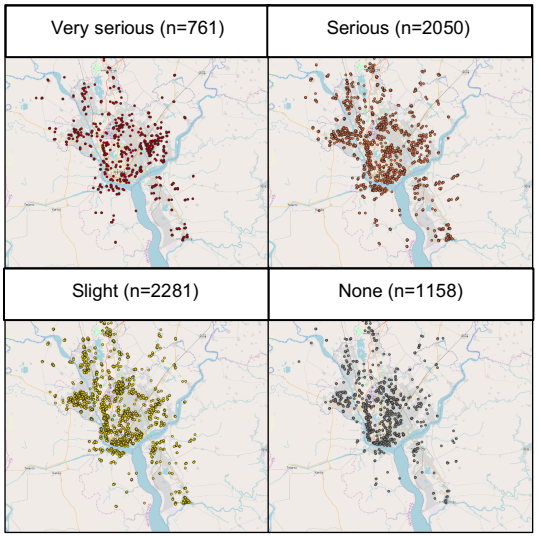

Figure 1 Geospatial distribution of property damage due to cyclone in Yangon City and surrounding areas

3. Results & discussion

3.1. Population distribution

Based on the survey responses, the percentage of affected households for each vulnerability indicator was identified including the level of property damage experienced for each group of susceptible population (Table 2). Results show that DISPREP (86%) and HQLT (83%) are the indicators which describe most of the population, i.e. most of the population do not have any disaster preparations and live in temporary housing units.

Table 2 Distribution of vulnerable population

Indicator	For total sample n=6250, %	By property damage, %			
		None n=1158	Slight n=2281	Serious n=2050	Very serious n=761
DISPREP	86	89	86	85	86
HQLT	83	71	82	89	90
HCON	55	43	51	62	66
GENRAT	49	52	49	48	51
EDLEV	43	33	39	50	54
EMPRAT	23	26	24	22	20
INC	20	15	17	23	26
DISED	15	14	15	17	15
ETH	10	12	10	9	9
AGERAT	5	6	5	5	3

In addition, 89% and 90% of those who experienced serious and very serious property damage respectively are characterized by vulnerable housing quality (HQLT).

3.2. Correlation matrix

Using Pearson's correlation analysis, it was found that the linear relationship among indicators is generally weak (Figure 2). The strongest correlations appear between ETH-HQLT (-0.14), HCON-HQLT (0.28), and AGERAT-EMPRAT (0.28). None of the variables are multicollinear and therefore may be treated as individual indicators affecting property damage.

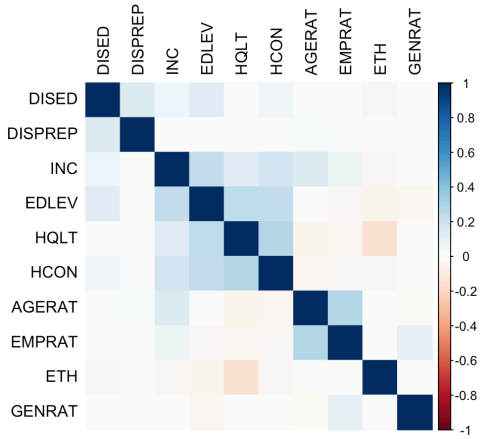

Figure 2 Correlation Matrix

3.3. Ordered logistic regression

Ordered logistic regression was performed to evaluate the relationship between each social vulnerability indicator and the different levels of property damage. HQLT (-0.6003), HCON (-0.3637), and EDLEV (-0.3122) appear to be the main influential factors which affect property damage (Table 3). These variables also have p-values less than 0.05 and thus have statistically significant effect on the level of property damage. Interpreting the odds ratio of the variables, it shows that "for a one unit increase in HQLT, the odds of moving from *very serious* to *serious, slight* or *none* are 0.5486 times greater, given that the other variables in the model are held constant. In other words, those who live in temporary housing have a higher probability of experiencing worse property damage than those who live in permanent housing. The same conclusion may also be said for HCON and EDLEV where, those with poor housing conditions and/or have lower level education have greater possibility of experiencing more severe loss and damages.

Table 3 Ordered logistic regression analysis

Indicator	Coefficients	p-value	Odds ratio
ETH	0.0684	3.80e-01	1.0708
INC	-0.2050	7.90e-04***	0.8146
EDLEV	-0.3122	6.52e-10***	0.7318
GENRAT	0.0297	5.23e-01	1.0302
AGERAT	0.1560	1.57e-01	1.1689
EMPRAT	0.1414	1.39e-02**	1.1519
HQLT	-0.6003	5.32e-19***	0.5486
HCON	-0.3637	2.31e-13***	0.6951
DISED	-0.0205	7.52e-01	0.9797
DISPREP	0.1749	8.90e-03**	1.1911
*Significance codes: 0 '***' 0.001 '**' 0.05 '*' 0.1 ' ' 1*			

4. Conclusion

This research aimed to examine the relationship between social vulnerability and property damage due to cyclones in Yangon City, Myanmar. Using data from a household interview survey, a set of indicators was obtained and evaluated to identify the vulnerability characteristics of the population. Results show that the lack of disaster preparations and living in temporary housing are the vulnerability criteria common to majority of the households. Findings from the ordered logistic regression analysis also showed that HQLT, HCON and EDLEV are the indicators which significantly affect the level of property damage experienced by the respondents. Households characterized by temporary housing, poor housing conditions, and/or lower education level are more likely to experience severe property damage. These results help identify community sub-groups that are more vulnerable to loss and property damage. Findings from this study can also be used as evidentiary basis for developing target-specific initiatives for disaster risk reduction including preparedness for response and recovery.

Acknowledgement

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References

[1] Cutter, S., Boruff, B., Shirley, W., "Social Vulnerability to Environmental Hazards," Social Science Quarterly, No. 84(2), pp. 242-261, 2003.