



## Household Disaster Management in Disaster Prone II of Mt. Slamet

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### ABSTRACT

**Objective** – This research aims to describe the factors influencing household disaster management of those living in the disaster prone II area of Mt.Slamet in Indonesia. The study focuses on the disaster prone II area surrounding Mt. Slamet, including five (5) villages from three (3) districts.

**Methodology/Technique** – A quantitative research methods is employed in this study. A total of 538 households were selected for examination using a two-stage stratified and systematic sampling. To describe the direct and indirect factors supporting livelihoods, Path analysis using a Stata tool analysis was used.

**Findings** – Multicollinearity was tested prior to the Path analysis. Among the 26 independent variables used, 12 independent variables had a statistical significance level of between 0.05 and 0.01. Labor force, transportation access, income, utilization of non-chemical fertilizer, transformation of process and structure, migration, livelihood changing, healthy household members, vehicle ownership, size of land for agriculture, access to electricity, and household networking to other parties located outside the village were the direct and indirect factors supporting disaster management of households living in the disaster prone II area of Mt. Slamet, Indonesia.

**Novelty** – The Indonesian government has classified the disaster prone II area as the highest risk area in which households are allowed to build their settlements. The study ultimately concludes that the government and other sectors could support households to strengthen their ability to manage disaster.

**Type of Paper:** Empirical.

**Keywords:** Household Disaster Management; Disaster Prone; Path Analysis; Mt.Slamet; Indonesia.

**JEL Classification:** D1, D10

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### 1. Introduction

It is critical for those living in close proximity to high risk areas to develop disaster management strategies in the event of disaster (Sutton and Tierney, 2006).

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To deal with the environment hazards, a 4 option framework described by Lewis (1999) and Wisner et al (2004) can be applied. However, the 4th framework element, “Live with Hazard and Risk”, is only applicable to households living in the areas with the highest risk of hazard.

This framework is integrated into environmental threats and opportunities, and accepts disasters as a usual part of life. Canon et al (2003) and Twigg (2004) use the Sustainable Livelihoods Approach (SLA) to reduce disaster risk. SLA by DFID implements a pentagon of factors including human capital, social capital, natural capital, physical capital and financial capital, which are influenced by outside policies, institutions and processes of living in a disaster area. Having sustainable livelihoods is strongly defined for smaller unit analysis, which could be described by reference to each household. The Indonesian government has set three different disaster prone levels categorized in order of risk. Disaster prone II was set as the highest risk area in which human occupation was allowed.

Indonesia is located in the ring of fire, which has experienced many natural disasters, including volcanic eruption. More than 150 active strato-volcanos are spread around all of the big islands; one of those volcanos is Mt. Slamet. Mt. Slamet is the second highest mountain in Java island, and has experienced more than 50 eruptions since 1988. Dewanti and Ayuwat (2015) describe Sawangan village, which is located on the border of disaster prone II and III, using their livelihoods concept. It had limitations on capital and brought them a living by self-sufficiency, with little support from the government. Hence, less capital was owned by households that had already experienced volcanic disaster and who currently resided in the Disaster Prone II area.

However, to recognize which households are able to influence the Disaster Management capacities of the households living in the Disaster Prone II area, further analysis is required. Households living in the Disaster Prone II area include families mostly working in the farming and tourism sector. Some parts boast urban living standards while others remain under-developed. To gain more data on this, the main objective of this study is to describe the factors influencing the ability for households living in the Disaster Prone II area to manage disaster.

Several areas in the Disaster Prone II area of Mt. Slamet already have well established survival practices gained through their local knowledge. Sawangan Hamlet and Guci Village are both partly located in the Disaster Prone II area of Mt. Slamet and both localities practice different methods of volcanic disaster management. Sawangan implements disaster management supported by social kinship while Guci applies a top to bottom leadership system, driven by local government (Dewanti and Ayuwat, 2016). In addition, outside institutions, policies and processes within the Disaster Prone II area have an influence on the capacity of households in that area to manage disaster. The Hyogo Framework Action for disaster management in Indonesia is described as the comprehensive process of mitigating, managing and responding to disasters (Matsuoka and Shaw, 2014). This comprehensive process includes stages involving mitigation, preparedness, response and recovery. Through the literature review conducted in this study, the following definitions are found:

1. Disaster Management refers to a household plan, practice and action for those who live on the border of the Disaster Prone II area, aimed at reducing risk and recovering from the impact of volcanic disaster through integrated activities including mitigation, preparedness, response and recovery.
2. Livelihood refers to household capital which influences the structure and process of access to livelihood resources.
3. Transforming structure and processes refers to the interaction between institutions and policies supported by the local culture and belief practices.

The definition of these terms gives rise to the following three hypotheses:

Hypothesis 1: Occupation, dependency ratio, labor force, health of household member(s), migration status, size of land, quantity of machine goods and vehicles all have an influence on a household’s disaster management capacity.

Hypothesis 2: The household capital of those living in the Disaster Prone II area consist of human capital, social capital, natural capital, physical capital and financial capital which all have an influence on disaster management.

Hypothesis 3: Transformation of process and structure consisting of land use management, spiritual practices and cultural implementation all have an influence on disaster management.

## 2. Research Methodology

This research aims to describe the factors influencing the livelihood of households living on the border of the Disaster Prone II area of Mt. Slamet, Indonesia. This study uses quantitative methods and uses selected household as the unit of analysis. The population in this area is divided into 5 sub-districts consisting of 4,268 households. To select the study area, a two-stage stratified sampling method was used to identify 3 districts based on the most impacted areas during previous eruptions, and to choose the villages in each districts based on their location in the Disaster Prone II area of Mt. Slamet. The samples were measured using the Hursh-Cesar (1981) method, measured using the finite population multiplied by 1.5. The result was 538 households in total (see Table 1). To select the respondents, a systematic sampling was used. The systematic sampling was measured using the 9th interval chosen from a list of households in each village. This study identified 3 dimensions as independent variables: household characteristics, capitals of households and transformation on process and structure. Disaster management is the dependent variable.

Table 1. Distribution of Households Living in Disaster Prone II Area

Sub-district	Village	Population	Percentage	Sample size
Bumijawa	Sawangan	664	14.35	78
	Guci	1,020	22.04	118
Bojong	Dukuh Tengah	830	17.95	97
Baturaden	Ketenger	1,012	21.87	117
Pulosari	Gunungsari	1,102	23.81	128
<b>TOTAL</b>		<b>4,268</b>	<b>100</b>	<b>538</b>

The household characteristics examined in this study include occupation, dependency ratio, labor force, number of healthy household member(s), migration status, amount of electrical goods and vehicles, and size of farming land. All of these indicators use a ratio data scale with the exception of occupation, which uses an ordinal scale. However, there are 2 dummy variables which are farming and non-farming occupations. Further, the capital of households examined in this study include human capital, social capital, natural capital, physical capital and financial capital. All of these variables use a ratio and interval data scale. Transformation, process and structure consist of land use management, spiritual practices and cultural implementation, all using an interval data scale. Finally, disaster management consists of mitigation, preparedness, response and recovery and uses an interval data scale.

This study was conducted using a Structured Interview Schedule (SIS) with multivariate analysis using the Stata (version 14) program. Content validity and measurement of reliability was measured using the Cronbach Alpha as 0.908 to determine the quality of the data. Content validity was confirmed by sending it to an expert in environmental studies and disaster management, to make improvements to the questionnaire. Since, this study employs a multivariate analysis on Path analysis, multicollinearity diagnostics were employed to examine the correlation between the independent variables. This may give rise to several

problems with the estimation and interpretation of  $\beta$ . Multicollinearity could be used in 3 ways: (1) examination of the correlation matrix; (2) VIF; (3) Eigensystem analysis of correlation (Joshi, 2012). This study employs a VIF measurement to test whether the data has a multicollinearity issue. Of the 25 independent variables (IV), no multicollinearity issues were found with the VIF between 1.09 to 2.15, or less than 10.

### 3. Results

The results of this study identify the factors influencing disaster management in 3 dimension being household characteristics, capitals of households and transformation of process and structure. This path model has an R squared of 33.44% as described in Figure 1. There were 8 independent variables having a direct effect (DE) on disaster management, including health of household member(s), labor force, amount of vehicles, size of farming land (Household Characteristics) household networking to others (Social Capital), use of chemical fertilizer (Natural Capital), access to electricity (Physical Capital) and transformation of process and structure. Chemical fertilizer and household networking were found to have a significant (0.00) impact on disaster management, with the unstandardized coefficient of 0.392 and 0.105.

There were 7 independent variables having an indirect effect (IE) on disaster management using transformation of process and structure as the mediator. These include labor force, migration status (Household Characteristics), livelihood (Human Capital), household networking (Social Capital), use of chemical fertilizer (Natural Capital), access to transportation/roads (Physical capital) and income (Financial Capital). Migration status and livelihood have an unstandardized coefficient of -0.0965\* and -0.0970\* respectively (with a significance level of 0.05). Further, most household members who migrate out of the area were male, being the head of the household and/or the son having marriage, education or working in another province. Ho, et al (2008) and Kung and Chen (2012) state that females are typically better prepared for disaster management however, during eruption, females are not able to bring their family to a safer place. Furthermore, labor force, household networking and the use of chemical fertilizers have both a direct and indirect effect on disaster management.

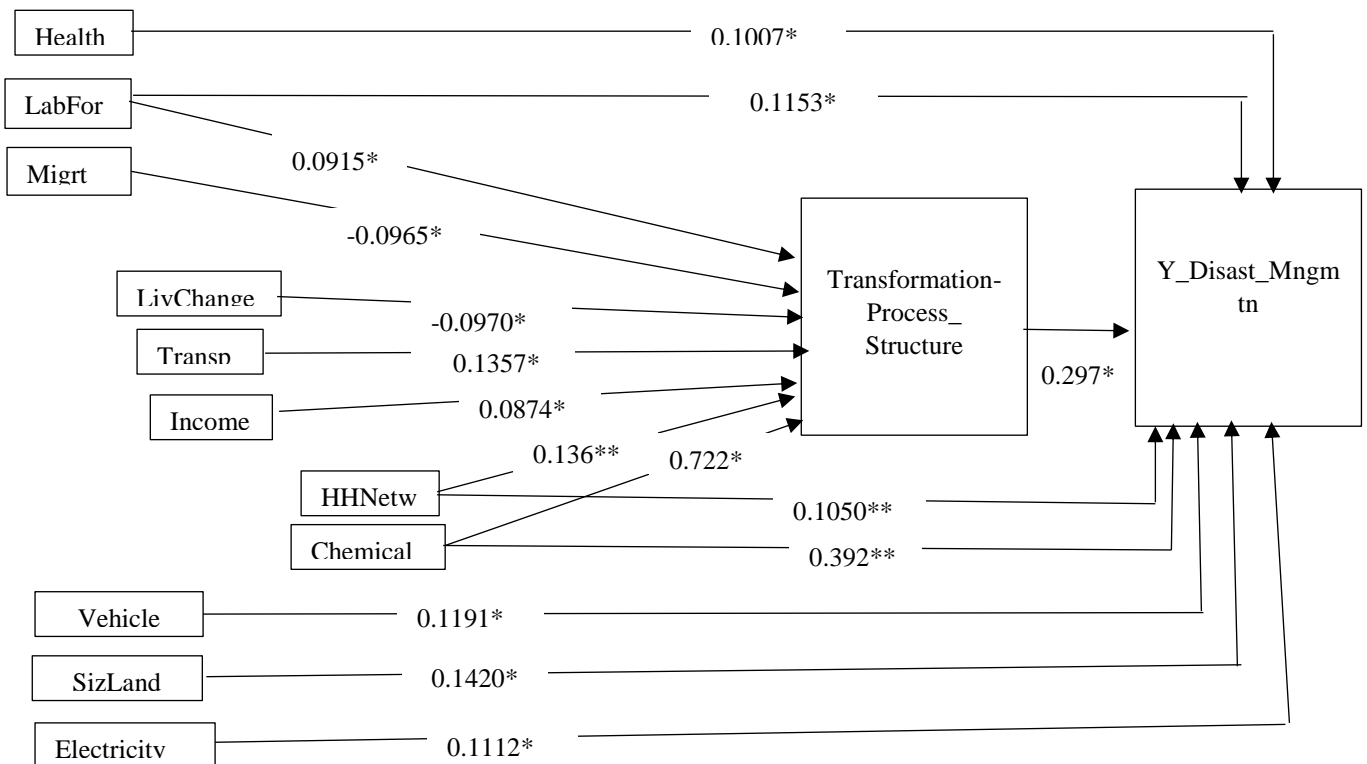


Figure 1. Path Analysis Result

## 5. Discussion

Through the findings of DE and IE among the 12 independent variables, it can be concluded that the variables that have DE and IE, being labor force and the use chemical fertilizers, support disaster management practices within households. Both of these variables therefore have a positive effect on disaster management. The number of households who have household members of working age had a total effect of 1.441 with a statistical significance level of 0.05 (see Table 2). The use of chemical fertilizer had a total effect of 1.411 with a statistical significance level of 0.01. Based on the measurement of the path analysis, it can be said that when the number of household members reaching working age is 1 or more members, the disaster management capacity of the household rises by 1.441. Further, when household members utilize non-chemical fertilizer, this may improve their disaster management ability by 1.411.

One of the interesting conclusions of this study is that migration has a direct effect on disaster management, with an unstandardized beta coefficient of 0.182 and a statistical significance level of 0.05. Therefore, it can be said that households who have 1 or more household member who migrates to different areas could experience a 0.182 decrease in their disaster management capacity. Koks, et al (2015) explains migration as the impact in social vulnerability from flood disaster. In this study, migration of household member(s) reduces disaster management capacity and causes an increase in social vulnerability. The results of this study can be used to predict which factors could be improved within household disaster management guidelines to strengthen those living in the high risk Disaster Prone II area of Mt. Slamet, Indonesia.

Table 2. Total Effect of Factors Influencing Disaster Management

Independent Variables	Direct Effect	Indirect Effect	Total Effect
Labor Force	0.1153	$0.9150 \times 0.1773 = 0.1622$	0.2775
Number of healthy member(s) in household	0.1007		0.1007
Migration	0	$(0.0965) \times 0.1773 = (0.0171)$	(0.0171)
Amount of vehicles	0.1191		0.1191
Size of Farming Land	0.1420		0.1420
Livelihoods changing	0	$(0.0970) \times 0.1773 = 0.0172$	(0.0172)
Household networking to others	0.1050	$0.136 \times 0.1773 = 0.0241$	0.1291
Chemical fertilizer utilization	0.722	$0.392 \times 0.1773 = 0.0695$	0.7912
Access to electricity	0.1112		0.1112
Income	0	$0.0874 \times 0.1773 = 0.0155$	0.0155
Transformation of Process and Structure	0.297		0.297

## 6. Conclusion

Based on the results of this study, in accordance with Hypothesis 1, 5 of the independent variables have a direct and/or indirect effect on disaster management. These include labor force, number of healthy household members, migration, amount of vehicles owned, and size of land. These findings are consistent with the study of Onuma and Managi (2016) who found that disasters could be handled by several characteristics of households with age, as people who were young were less likely to be prepared for disaster. That study also held that the number of healthy household members is an important factor influencing disaster management. Since households who live in the Disaster Prone II area mostly rely on natural resources and live in rural households, the size of land has a direct influence on disaster management (CARD, et al. 1999).

Hypothesis 2 is consistent with the core concept of Lewis (1999) and Wisner et al (2004) who identified four frameworks to manage volcanic disaster. However, this study only uses the fourth framework, described as “live with hazards and risk”, using household assets or capital to manage volcanic disaster. Hoffmann and

Muttarak (2017) examine the preparedness stage using social capital and disaster risk perception. This study found that an increase in social capital causes an increase in disaster management capabilities. In summary, the capitals of households have a significant influence on disaster management both directly and indirectly.

Hypothesis 3 in this study can be described in 3 parts being land use management, spiritual implementation and culture practices. The variable of transformation of process and structure has a positive influence on disaster management and plays an important role as the bridge between some variables of household characteristics and the capitals of households. In line with this hypothesis, this study shows that the transformation of process and structure has a positive influence on disaster management as the outcome activities for households living in the Disaster Prone II area of Mt. Slamet. These findings are supported by DFID (1999) and Scoones (1998) who describe transformation of process and structure as the engine of households to achieve an outcome. In this study, spiritual and culture practices influenced on the disaster management capacities of households. The cultural practice known as Ruwat Bumi refers to the collaboration between households each year who live in the Disaster Prone II area and the local government. Cultural practices are the engine of the practice of household beliefs in disaster management. Stemming from the heritage of past ancestors, the transformation of process using cultural practices is not only used by the households, but is also supported by the government.

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