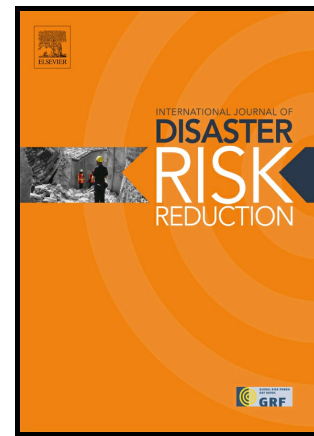# Author's Accepted Manuscript

Social Vulnerability at a Local Level around the Merapi Volcano

Yohana Noradika Maharani, Sungsu Lee, Seo Jin Ki

www.elsevier.com/locate/ijdr

Cite this article as: Yohana Noradika Maharani, Sungsu Lee and Seo Jin Ki, Social Vulnerability at a Local Level around the Merapi Volcano, *International Journal of Disaster Risk Reduction,* http://dx.doi.org/10.1016/j.ijdrr.2016.10.012

Social Vulnerability at a Local Level around the Merapi Volcano

Yohana Noradika Maharani[1], Sungsu Lee[2], Seo Jin Ki[3]

[1]Department of Civil System Engineering, Chungbuk National University, Republic of Korea
[2]School of Civil Engineering, Chungbuk National University, Republic of Korea
[3]School of Environmental Science and Engineering, Gwangju Institute of Science and Technology, Republic of Korea,

Corresponding author: Sungsu Lee, email: joshua@chungbuk.ac.kr

Abstract

Hazards affect people regardless of their socioeconomic situation. This study proposes a computational method for data analysis in terms of the number of social vulnerability variables and samples of the case study in the Merapi proximal villages. For this purpose, the Self Organizing Map is considered as an effective platform to identify the sites according to their similarity and to determine the most relevant variables to characterize the social vulnerability in each cluster; while Social Vulnerability Index is used for vulnerability index creation to measure the level of vulnerability. The dataset used for this analysis consisted of 12 variables, which represent the socioeconomic concepts, and collectively represent the situation of the study area, based on fieldwork conducted on September 2013. However, some of the variables employed in this study might be more or less redundant. The results showed that quantification and topographic errors presenting degree of accuracy of the representative data samples arranged in hexagonal map units varied considerably depending on the map size of the SOM. This indicated that some data samples require the removal of redundant variables. When we investigated the relative importance of variables in the reduced dataset, the parameters related to the number of migrate-in population (MOVEPPLIN) and the number of females (PRCTFEM) had the most significant impacts on the social vulnerability. From this study, we demonstrated that the SOM approach provided reliable estimates of clustering and the most significant variables, while SoVI works well in ensuring that positive value indicates high vulnerability, and vice versa.

Keywords: Social vulnerability, Self Organizing Map, Social Vulnerability Index, Cluster analysis, Merapi

1. Introduction

Quantifying vulnerability is increasingly considered to be a significant component of effective disaster risk reduction and building resilience [3]. Vulnerability is the characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard [43]. In many parts of the world, natural hazard can cause enormous calamity in multiple ways such as physical, psychological and financial that affect people at all levels. The impact will be harsher when it occurs to individuals or communities who already face some drawbacks; for instance, children, the elderly, those in poverty, migrants and people with disabilities. These people often lack resources, and are hit hardest and longest in the environment of disaster and emergencies, as well as considered socially vulnerable in the face of disaster, whether it is due to their capacity to evacuate or contributing to a slower recovery in the event of a disaster. Social vulnerability refers to the characteristics of a person or group and their situation that influence their capacity to anticipate, cope with, resist, or recover from the impact of a hazard [50].

In this study, the villages proximal to Merapi volcano are considered in the analysis of social vulnerability. Although volcanic hazards contribute just a small percentage to global losses, they have unique characteristics that require particular consideration, as the effects are more complicated when the volcano is located in a densely populated area. Due to rapid population growth and the influence of urbanization, more than 500 million people worldwide are currently believed to be exposed to the danger of volcanic hazards, since they live in the proximity of active volcanoes [35,41]. It also implies that these people are potential victims, in need of assistance and incapacitated [6]. In order to emphasize the need for a social vulnerability assessment in risk disaster management, research and practical usage of social vulnerability has been explored recently, and has also become an issue of concern by stakeholders as part of disaster risk reduction. One of the methods that is

1