Geohazard Mitigation Based on Local Wisdom for Limestone Mining Site in Padalarang Area of West Java

Evi Haerani¹, Euis Maemunah¹, Nur Hamid¹, Ghazi O. Muslim², Dicky Muslim², Miki Matsumoto³

¹Dept. of Mining, STTMI Sekolah Tinggi Teknologi Mineral Indonesia
²Faculty of Geological Engineering, Universitas Padjadjaran, Indonesia
³Faculty of Regional Design, Utsunomiya University, Japan

*Corresponding email: evi.haerani@sttmi.ac.id and d.muslim@unpad.ac.id

Abstract. Padalarang area of Bandung Barat Regency is famous as location of limestone mining site in West Java Province. Several geological hazards such as landslide, soil erosion and sedimentation are frequently happen in the study area. Despite the environmental damages due to geohazards, there are still many people living in this area. The objective of this paper is to reveal the efforts of disaster risk reduction based on local knowledge and wisdom of people living around the limestone quarry. Methodology in this study consists of geohazards potential mapping to delineate the area of vulnerability and mapping of the people’s knowledge and experiences in their efforts to reduce the risk of disaster around their environment. Results show that several quarries in the study area are prone to landslide and rockslide with high vulnerability. Soil erosion and sedimentation are traceable in the rivers. Native inhabitants around mining site get used to build their homes on the slope in a traditional way to avoid the danger of sliding. Even though the recent home building is popular using bricks but in some cases, the traditional building is expected to be more resilient to geohazards. Stone Garden and Guha Pawon are means of keeping environmental friendly and part of geohazard mitigation.

1. Introduction

Padalarang area of Bandung Barat Regency is famous as location of limestone mining site in West Java Province. Based on the report of regional geology this limestone belongs to the Miocene Rajamandala Formation [1]. It had been mined since Dutch colonial era about 80 years ago. In this area, the potential and mineable resources consist of limestone, marble, andesite, sand, etc.

This limestone sediment is categorized as karst area with unique appearances [2]. Geomorphology of the study area mainly consists of hilly to mountainous terrain. Several peaks of hills are used to be
the site for rock climbing sport such as Pasir Pabeasan (famous as Citatah 90 steep slope hillside), Pasir Manik (Citatah 49 steep slope hillside), Pasir Singgalang (Citatah 125), Pasir Karang Panganten, Pasir Pawon (famous for the existence of prehistoric Pawon Cave), etc.

Almost every year especially during the rainy season, the study area has frequently undergone several geological hazards such as landslide, soil erosion and sedimentation. Landslide hazard in this area is predominantly categorized as a compound landslide especially around Citatah Village [3]. The compound landslide is a combination of the most significant size to the smallest size landslide and avalanche products such as slope, glide, and rock fall. The avalanche in Pasir Pabeasan is a composite long-type with horizontal distribution (lateral spread).

Until recently, native people of this area grow concern of maintaining environment through local knowledge and wisdom. Local wisdom is defined as respect for local culture [4]. This emerged as a sense of collectivism, solidarity and tolerance which was embedded in the daily life of the community. Local wisdom is recognized as value and practices that the local community has adopted. Understanding the strong local culture that the community has, the local government then set up programs and involved the community in the process of such programs. This concept gave the community the opportunity to decide on the type of activities that matched local needs.

The objective of this paper is to reveal the efforts of disaster risk reduction based on local knowledge and wisdom of people living around the limestone quarry.

2. Data and Method
Methodology in this study consists of analyzing published geohazards potential map to delineate the area of vulnerability and mapping of the people’s knowledge and experiences in their efforts to reduce the risk of disaster around their environment.

Data are collected through deskwork analysis of published maps and reports. Field survey was conducted to obtain people’s knowledge and perception qualitatively about local potential development to support their livelihood out of mining industry around limestone quarry. Field Surveys were administered through a drop-off/pick-up survey.

Results show that native inhabitants around mining site get used to build their homes on the slope in a traditional way to avoid the danger of sliding, eventhough the recent home building is popular using bricks but in some cases, the traditional building is proven to be more resilient to geohazards due to the limestone quarry in hilly geomorphic terrain (See Figure 1).
Several quarries in the study area are prone to landslide and rockslide with high vulnerability. Soil erosion and sedimentation are traceable in the rivers (see Figure 2).

Despite the environmental damages due to geohazards, there are still many people living in this area. The study area continues to witness the exploitation of its resources, especially limestone and marble for many kinds of purposes. This mining industry has created a long-term conflict between the ideas of conservation to protect the environment and the industry to exploit resources. Inhabitants are divided into two groups, the pros and cons, generating disputes due to their source of income and environmental concerns.

Local wisdom can be utilized as the socio-ecological values among people living around the quarry, where local community knowledge systems can be basic principles in managing natural surroundings around the quarry [5]. This knowledge is meant to develop basic strategies for the maintenance of livelihood towards achieving green era such as creating Smart City concept.

In the study area, the people start to look for other source of income based on the karst sediment condition that is through geotourism. This idea is based on sustainable concept to reduce the exploitation of natural resources. They support the rock climbing sport locations and create more interesting locations for tourism. The establishments of the Stone Garden and Guha Pawon are means of keeping environmental friendly and part of geohazard mitigation (see Figure 3).
To maintain the spirit of environmental concern for local community, it is necessary include the education system in the study area as stakeholder [6]. Schools can participate to educate the community through the pupils in terms of environmental concern [7]. Teachers and students are expected to become the agents for managing sustainable nature. The school community is also capable to take the role for geohazard mitigation [8].

3. Conclusions
This paper concludes that there are disputes around limestone quarry between the exploitation of resources and conservation to maintain the safe and healthy environment. Local wisdom and knowledge are utilized to support the effort for disaster risk reduction or mitigation through development of geotourism. To maintain this sustainable effort, it is necessary to include school’s community for educating the inhabitants in the future.

This mitigation report is intended to support preparing the resilient of community toward future hazard exposure as well as the intention to create Smart City in the future for the particular area.

Acknowledgement
This article’s publication is supported by the United States of Agency for International Development (USAID) through the Sustainable Higher Education Research Alliance (SHERA) Program for Universitas Indonesia’s Modelling, Application, Research and Training for City-centered Innovation and Technology (SMART CITY) Project, Grant #AID-497-A-1600004, Sub Grant #IIE-0000078-UI-1.

References

[1] Sudjatmiko 1994 Geologic Map of Cianjur Quadrangle Java, Scale 1:100.000 (Center, Bandung, (2nd: Geological Research and Development)

[2] Maulana Y C 2011 Sustainable Development for Karst Area of Citatah-Rajamandala REGION 3 1–14

[3] Mulyadi D 2018 Spatial Data of Landslide Disasters West Bandung, IOP Conf. Ser. Earth Environ. Sci 118 12039

[4] Kusumasari B and Alam Q 2012 Local wisdom-based disaster recovery model in Indonesia Disaster Prev. Manag. An Int. J. 21 351–369

[5] Himawan W, Sjarkowie F and Alfitri 2014 Local Wisdom from the Socio-Ecological Perspectives: Managing Former Mine Lands in Achieving Green Era IOSR J. Humanit. Soc. Sci. 19 52–57

[6] Haerani E, Muslim F N, Muslim G O, Muslim D, Kagawa N and Shibayama M 2015 Geohazards Awareness And Education For The Society, Case Studies For University And Geoscience Challenge for Future Energy and Environment Sustainability (Indonesia: Faculty of Geological Engineering, Universitas Padjadjaran, Indonesia)

[7] Dicky M, Haerani E, Shibayama M, Ueshima M, Kagawa N and Hrnawan F 2015 Disaster Awareness Education in Schools around Geological Hazards Prone Areas Eng. Geol. Soc. Territ. 6 107–112

[8] Shibayama M, Kagawa N, Ueshima M and Muslim 2012 Earthquake and Tsunami Disaster Prevention Education for Children in Indonesia Abstract and Technical Program of the 34th International Geological Congress (IGC) (Brisbane, Australia: Session of Geoscience Education) p 103