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## MANAGEMENT OF THE MOUNT SEMERU ERUPTION DISASTER THROUGH SOCIAL CAPITAL

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### ABSTRACT

People, wherever they are, are very vulnerable to natural disasters, especially those living in disaster-prone areas. Natural disaster relief efforts can involve a wide range of social capital. Indonesia is crossed by various tectonic plates and has many active volcanoes, one of which is Mount Semeru in East Java. This research compares the role of social capital in efforts to deal with natural disasters in various regions and includes qualitative research with a case study in Sumbermujur Village, Candipuro District, Lumajang Regency, Indonesia. The role of social capital is very important both before the disaster occurs, when the disaster occurs, and when recovering from the disaster. The main sources of social capital in the Sumbermujur community are trust, local wisdom, and social capital linking. This research also highlights the importance of social capital as a disaster mitigation effort to be instilled in the younger generation, namely through disaster mitigation education in schools.

**KEYWORDS:** eruption, local wisdom, natural disaster, social capital

### 1. INTRODUCTION

Every year, disasters come and go. Disasters can be divided into hydrometeorological disasters and geological disasters. Quoting from BNPB (2021), hydrometeorological disasters are disasters that are closely related to seasons, namely floods, tornadoes, landslides, tidal waves or abrasion, drought, and forest and land fires. Meanwhile, geological disasters, which are not affected by the seasons that occur but are caused by movements from the bottom of the earth that appear on the surface, can occur at any time, and it is difficult to predict when they will occur. Geological disasters, namely tsunamis, earthquakes, and volcanic eruptions.

Geological disasters that occurred in Indonesia during 2010-2021 were earthquakes in Aceh in 2013 and 2016, eruptions of Mount Sinabung during 2010-2020, eruptions of Mount Kelud in 2014, eruptions of Mount Agung in 2017, earthquakes in Lombok in 2018, earthquakes, tsunamis, and liquefaction in Central Sulawesi in 2018, the Sunda Strait tsunami in 2018, an earthquake in Maluku in 2019 (BNPB, 2021), and the eruption of Mount Semeru in 2021. These disasters resulted in fatalities, missing people, injuries, and displacement. Of course, it also resulted in damage to people's homes and public infrastructure.

During the period from 2011 to 2020, the disasters in Indonesia that claimed the most lives were the earthquake, tsunami, and liquefaction in Central Sulawesi Province in 2018, the earthquake in West Nusa Tenggara Province in 2018, and the tsunami in Banten and Lampung Provinces in 2018. 2018. The impact of natural disasters is not only fatalities, but of course infrastructure damage, many people losing their homes, ecosystem and environmental destruction, as well as difficulties in meeting logistical needs. While the non-physical impacts are psychological health problems such as stress and madness, lifestyle changes, and damage to business activities (Tohani & Wibawa, 2019).

This research discusses a geological disaster, namely the eruption of Mount Semeru in 2021. Mount Semeru erupted in 2021, releasing both hot clouds and cold lava. As a result, dozens of people died, several were declared missing, thousands of houses were damaged, and even volunteer cars were washed away with the cold lava. The purpose of this study is to determine how much social capital the people of Sumbermujur Village, Candipuro District, and Lumajang Regency have in dealing with Mount Semeru's eruption.

## 2. METHODS

This study is qualitative and employs a case study approach. The research was conducted in Sumbermujur Village, Candipuro District, and Lumajang Regency after the eruption of Mount Semeru. This study also uses various supporting previous research materials, especially research that discusses the benefits of social capital for efforts to deal with natural disasters. The data was cross-checked using research source triangulation.

## 3. RESULTS AND DISCUSSION

### 3.1 Indonesia as a "Ring of Fire"

Indonesia is a country in Southeast Asia. Indonesia's latitude and longitude are 5° 00' N and 120° 00' E (World Map, 2021). Indonesia is situated on three plates: the Eurasian Plate, the Indo-Australian Plate, and the Pacific Plate. These three plates are active tectonic plates that form volcanoes. Indonesia itself is known as the "Ring of Fire" because it has many active volcanoes. Indonesia is estimated to have 129 volcanoes, all carefully observed by the Center for Volcanology and Geological Hazard Mitigation, because a number of Indonesian volcanoes show continuous activity. Being located on the Pacific Ring of Fire, which is known as an area with a high degree of tectonic activity, Indonesia has to cope with the constant risk of volcanic eruptions, earthquakes, floods, and tsunamis (Indonesia Investments, 2022).

The following is a map illustrating the existence of volcanoes in Indonesia.



Figure 1. Types of volcanoes in Indonesia

Source: Magma Indonesia (2021)

Based on Figure 1, it can be seen:

- *Type-A volcano*, totaling 76 mountains, is a volcano that has a historical record of eruptions since 1600.
- *Type-B Volcano*, totaling 30 mountains, is a volcano that has a history of eruptions dating back to before 1600.
- *Type-C Volcanoes*, totaling 21 mountains, are volcanoes that have no recorded history of eruptions but still show traces of volcanic activity, such as solfatara or fumaroles.
- *Submarine Volcanoes*, indicating an underwater volcano.

Mount Semeru is classified as a Type-A volcano. Mount Semeru's latitude is -8.11284536216 and longitude is 112.92476270100 (Magma Indonesia, 2021). Administratively, Mount Semeru is located in Malang Regency and Lumajang Regency, East Java Province, Indonesia. Mount Semeru has the Mahameru peak with a height of 3736 m above sea level and the Jonggring Seloko lava dome with a height of 37744.50 m above sea level (Suparman et al., 2011). This case study research was carried out in Lumajang Regency, specifically in Sumbermujur Village, Candipuro Subdistrict. The topography of Lumajang Regency consists of mountains, mountains, fluvial plains, and alluvial plains. Sumbermujur Village, Candipuro Subdistrict, in Lumajang Regency has an area of 14,309 hectares

and is classified as a mountainous area. In 2020, the total population of Sumbermujur Village was 73,617 people (BPS Kabupaten Lumajang, 2021). Sumbermujur itself is a village that is prone to the effects of the eruption of Mount Semeru.

During the 2018–2020 period, Mount Semeru erupted 26 times. During the 2021 period, Mount Semeru also experienced many eruptions. In 2021, the Center for Volcanology and Geological Hazard Mitigation (CVGHM) has issued an early warning for the danger of an eruption of Mount Semeru. Early warning is given not only for the danger of the Mount Semeru eruption but also for other active volcanoes in Indonesia. On December 1, 2021, glowing lava avalanches occurred on the slopes of Mount Semeru, and the information has been provided via WhatsApp Group to the local government, the Disaster Management Center (BPBD), and volunteers on duty at the guard post. On December 2, 2021, a warning was also given so that the public does not carry out activities around risky areas to avoid hot clouds falling. On Friday, December 3, 2021, there was a small eruption. On Saturday morning, December 4, 2021, conditions were monitored to be safe. However, it rained from noon to evening and coincided with hot clouds falling from Mount Semeru (Kompas.com, 2021).

### 3.2 Natural Disasters

There are three stages in disaster management efforts (BNPB-NTB, 2022), namely:

- *The pre-disaster stage*, carried out when there is no disaster and when there is a threat of a potential disaster.
- *An emergency response stage*, is designed and implemented when a disaster occurs.
- *Post-disaster stage*, dealing with the aftermath of a disaster.

Due to Indonesia's geographical position, which is prone to natural disasters, the pre-disaster stage is important to reduce the impact of the natural disasters that will occur. The pre-disaster stage is also called disaster mitigation. Mitigation, according to Coburn et al. (1994), means taking action to reduce the effects of a hazard before it occurs. Disaster mitigation is an action to reduce the effects of a disaster before it occurs. In various disaster-prone areas in Indonesia, various disaster detection tools have been installed that are part of the Early Warning System (EWS). Volcanic eruptions are generally gradual, so the existence of a disaster detection device is a disaster mitigation effort so that evacuation of residents can be carried out in a timely manner (Coburn et al., 1994).

Vulnerability is the level of damage expected from a particular hazard. Vulnerability comes not only from buildings but also from social groups or economic sectors (Coburn et al., 1994). According to Tohani and Wibawa (2019), the impact of natural disasters includes not only loss of life and infrastructure damage, but also non-physical effects. This is where the importance of social capital for disaster mitigation efforts lies.

### 3.3 Social Capital

According to Hanifan (1916), social capital is not money, but rather goodwill, friendship, mutual sympathy, social relations, and close cooperation among individuals and families who form a social group. The three forms of social capital are bonding, bridging, and linking (Woolcock & Narayan, 2000; Sadeka et al., 2015; Sasaki et al., 2020).

The following is an explanation of each form of social capital.

- Social bonding capital, defined as relationships between people who are in similar situations and have strong bonds (Sadeka et al., 2015), such as family, close friends, and neighbors, as well as relationships between people who have the same social identity as class or race (Sasaki et al., 2020), is also related to kin, religious, and ethnic-based relationships (Colletta & Cullen, 2022).
- Bridging social capital, which includes bonds between similar people (Woolcock & Narayan, 2000), as well as weaker, less dense, but more cross-sectoral bonds (Sadeka et al., 2015; Colletta & Cullen, 2022), such as those formed through connections across class, race/ethnicity, and other social identity boundaries (Sasaki et al., 2020).
- Then, social linking capital, which is defined as the relationship between parties in different situations (Woolcock & Narayan, 2000), social linking capital is defined as the relationship between them in a hierarchy with different levels of strength (Sadeka et al., 2015), such as the community and the government (Colletta & Cullen, 2022), social service agencies that deal with individuals, and other control forces (Sasaki et al., 2020).

Quoting from Colletta & Cullen (2022), bonding and bridging social capital are horizontal social capital, which is ties within and between communities, while linking social capital is vertical social capital, which is state and market links with communities. "The greater the bonding and bridging of horizontal social capital links with vertical social capital, the more likely a society will be cohesive" (Colletta & Cullen, 2022). Social bonding capital is established between the closest people with strong bonds and horizontal relationships. Meanwhile, bridging social capital is weaker, but the relationship is established between equal or horizontal parties. Then social linking capital is established between unequal or vertical parties.

Social capital can be positive or negative. Social bonding and bridging capital generally already exist in the community and can be an effective disaster management effort. But this social linking capital still needs to be worked on again. Putnam surveyed the decline in social capital in the United States since 1950 and found that Americans have experienced a decline in trust in government (Putnam, 2000). Putnam's (2000) emphasis is on active participation in networks, reciprocity, and the trust that arises from them. Social capital is also important for disaster management efforts. The government definitely has a strategy for disaster management efforts, including, for example, evacuation routes, providing logistical assistance and accommodation, as well as efforts to transmigrate to safer areas. If

the community does not have social capital with the government, it will be difficult to implement the disaster management strategy that has been designed by the government.

For example, in Afdilla's research (2019) in Kepuharjo Village, the community only trusts certain people, for example, the caretakers of Mount Merapi. This made social capital a negative thing because it made the disaster mitigation process at that time difficult to do. Related to disaster management efforts, social capital is said to be positive if it can support the disaster mitigation process. For example, if the community has trust and builds a network with volunteer communities and the government, Community networks can be successful if they are supported by good communication and there is trust between community members (Afdilla, 2019). According to Tohani & Wibawa (2019), it is an important matter for the implementation of community empowerment related to the utilization of social capital for community capacity building.

According to Hidayati (2018), social capital plays a role in disaster risk reduction at the local level. In the Great East Japan Earthquake disaster, physical infrastructure improvements can indeed reduce disaster risk, but social capital is also important for fostering social awareness in community networks (Sasaki et al., 2020). Meanwhile, the people of Kepuharjo Village are the ones affected by the 2010 eruption of Mount Merapi. According to Afdilla's research (2019), the social capital possessed by the people of Kepuharjo Village is 1) internal community networks (fellow villagers) and external community networks (involving the government) that were built to fulfill needs, such as information, disaster mitigation, assistance, etc.; 2) commitment (commitment between the parties involved); and 3) reciprocity (relationships established based on trust and mutual assistance without coercion).

The social capital of the people of Pagerharjo Village, especially trust, is included in disaster mitigation efforts so as to minimize the impact of landslides (Ruslanjari & Dewi, 2018). Research by Jovita et al. (2019) on Filipino communities affected by Typhoon Washi also showed that trust in social capital refers to the extent to which disaster survivors can rely on close family members, neighbors, close friends, NGOs and religious organizations, elders or community leaders, and the government to meet their needs. basic needs and to improve socio-economic conditions. In Zuber's (2019) research location, where floods frequently occur, the social capital owned by residents is trust. Residents jointly carry out disaster mitigation by collecting financial contributions and then working together to repair waterways, raise roads, and take care of garbage disposal. This social capital of trust for disaster mitigation has proven to be effective in dealing with disasters.

Behera (2021) conducted a literature review with special reference to Puri District, Odisha State, India, which is a disaster-prone area. Among the three types of social capital, social bonding capital is very relevant when a disaster occurs, such as for rescue and evacuation, the provision of food and drink, relief services, and psychological support for people affected by disasters (Behera, 2021). Then, during the eruption of Mount Bromo, the Tengger Community had social bonding, bridging, and linking capital, and local wisdom could also be used for disaster management (Radyan et al., 2019). Local

wisdom is often taken for granted. In fact, if local wisdom is rooted in society, it can play a role in disaster management. The people of Pagerharjo Village have local wisdom from their ancestors regarding disaster management efforts (Ruslanjari & Dewi, 2018). On Simeulue Island, Aceh, there is local wisdom in the form of a song about Smong or the tsunami, which teaches that if there is an earthquake and then the sea water recedes, people should flee to higher ground, and this song saved most of the population of Simeulue Island from the 2004 tsunami (Hidayati, 2018).

Based on the literature, it can be concluded that the social capital used for disaster management—social bonding capital (Behera, 2021; Radian et al., 2019), bridging and linking (Radian et al., 2019), trust (Afdilla, 2019; Jovita et al., 2019; Ruslanjari & Dewi, 2018; Zuber, 2019), networking (Afdilla, 2019; Sasaki, Social capital is often overlooked because it is not something that is physically visible, such as disaster mitigation by improving infrastructure or providing Early Warning System equipment in disaster-prone areas where there is a clear physical presence. Social capital is the strength of the community itself to deal with natural disasters.

There are several other solutions that can be implemented for post-disaster management; for example, after the 7.9 on the Richter scale earthquake in 2007 in Bengkulu, residents agreed on a relocation point 1.2 kilometers from the current village position, teaching students about disasters and how to handle them, and the proposal to have a logistics warehouse in each district. The logistics warehouse is an effort to provide food and medicine when a disaster occurs and protect residents from the cunning practices of distributors who raise prices when a disaster occurs. Natural disasters, in addition to claiming many lives and damaging infrastructure, also have a psychological impact on disaster survivors. After the earthquake, the community learned a valuable lesson so that they always prepared a flashlight beside their bed and at the door of their house because, during an earthquake, the electricity would go out and people would become blind (Rachman, 2012).

According to Rusmiyati and Hikmawati (2012), the handling of the social psychological impact of the Merapi eruption disaster can be seen from the perspectives of fulfilling physical needs (consumption, safe housing, health services, education, clean water, and sanitation), fulfilling psychological needs (many refugees experience disturbances of psychological trauma due to trauma; feelings of sadness due to loss of family, property, and home, including livelihoods; and feeling strangers in refugee camps), and fulfillment of social needs (non-fulfillment of life's necessities, not optimal function and role of the family, disappointment with government services, and possible loss of self-control can potentially trigger social action).

Based on research by Tohani and Wibawa (2019) in Girikerto Village, Special Region of Yogyakarta, Indonesia, which is a village that is vulnerable to the effects of the eruption of Mount Merapi, the use of social capital is more prevalent before a disaster occurs. Social capital is indeed useful for natural disaster mitigation efforts. Communities that already have strong social capital will also be stronger when facing disasters and will find it easier to recover after a disaster occurs. Social capital in the

community will not be easily shaken due to the natural disaster crisis, but it must still be nurtured to be effective. Jovita et al. (2019). Because after all, natural disasters must have left a psychological impact on the survivors (Rachman, 2012; Rusmiyati & Hikmawati, 2012; Tohani & Wibawa, 2019).

### 3.4 Javanese People and Local Wisdom

According to Asy'ari (1993), when viewed from a morphological and economic aspect, a village is an area whose inhabitants use the land for activities in the agricultural or agrarian sector. In village communities, there are binding forces or village alliances, namely kinship, attachment to territory, certain powers based on values, certain powers based on expertise or skills, and dependence on village leaders (Asy'ari, 1993). The respect for elders (Asy'ari, 1993) reveals the village community as a paternalistic society, with decision-making left to the elders or village elders. Village elders, parents, and village officials have the responsibility for social control in the village. Sumbermujur Village is located in East Java, and of course the people are classified as village people who still have obedience to village elders or parents who are respected in the village. These village elders can be the key to inviting village communities to follow the government's directives regarding disaster management efforts. Communities that have trust in the government and comply with regulations can facilitate the evacuation process when a disaster occurs (Tohani & Wibawa, 2019). Local leaders can hold regular meetings and also meet at social events to discuss efforts to prepare communities to be better prepared for natural disasters.

In Triyoga's thesis (2010), the Javanese in their lives not only respect their fellow human beings but also nature and the supernatural realm, for the sake of maintaining the unity and harmony of the cosmos. They grow with nature, thus realizing that nature can threaten human life. The teachings of the ancestors are not to master nature but to learn how to adapt to it. The Javanese have their own belief system. The belief system of the Javanese is not only to identify good goals and ways of life but also includes ways to identify threatening dangers, where they come from, and how to deal with them (Triyoga, 2010). Local wisdom plays a role in community efforts to seek help and recover from the effects of natural disasters (Hidayati, 2018).

Sumbermujur is a tourism village based on agribusiness, agriculture, and freshwater fisheries in Candipuro District, Lumajang Regency, East Java. Sumbermujur Village has 426 hectares of rice fields, 400 ha of agricultural fields, 297 ha of Perhutani plantations, and 14 ha of bamboo forests (Jadesta, 2022). In the bamboo forest area of Sumbermujur Village, there is a Sumber Deling spring. Sumber Deling Spring is located in the middle of a 14-hectare bamboo forest with a water discharge of 600–800 liters per second during the dry season and 1,300 liters during the rainy season. The Sumber Deling spring fulfills household needs and irrigates the rice fields of residents around Umbulrejo Hamlet, Umbulsari Hamlet, Krajan Hamlet, and Wonorenggo Hamlet (Kompas.com, 2013). The bamboo forest area is irrigated by a spring that irrigates 891 ha of rice fields, which are not only in Sumbermujur Village but also in other villages, namely Penanggal Village, Tambahrejo Village, and Kloposawit Village, as well as Pandan Village during the dry season (Jadesta, 2022).



Lessons learned in the 1970s, namely when the Sumber Deling water flow decreased due to the felling of the bamboo forest by the local people, made the people aware of the importance of protecting the bamboo forest for the preservation of the Sumber Deling water resource. Then they made Village Regulation No. 1 of 2000 concerning the prohibition of logging bamboo without permission from the village government and bamboo forest managers, as well as Village Regulation No. 6 of 2007 concerning the prohibition of taking or destroying flora and fauna in bamboo forest areas (Kompas.com, 2013). Now the bamboo forest area in Sumbermujur Village is really guarded by the local community. The bamboo forest is so beautiful that it is also inhabited by groups of bats and groups of long-tailed monkeys. The bamboo forest is not only a source of water and a home for fauna but is also being developed into a tourist spot. The entrance ticket to the bamboo forest tourist spot in Sumbermujur Village is no more than five thousand rupiahs, so it is very affordable for the community.

Every year the people of Sumbermujur Village hold a Mahesa Suroan event, which is a tradition that is carried out every 1 Suro (1 Muharam) as a form of gratitude for abundant water. This tradition is a form of human appreciation for nature because, if it is not maintained, nature will be angry and cause havoc. The people living on the slopes of Mount Semeru, namely the residents of Sumbermujur Village, held a ruwatan event to avoid the volcanic eruption (Donartono, 2014). Ruwatan begins with the Reog dance and gamelan beats, then brings offerings to the Sumber Deling spring. The offerings include a cow's head, a yellow rice cone, traditional snacks, and nutmeg kependem (various kinds of tubers). The cow's head will be buried under a bamboo tree on the edge of a spring.

Aside from being a spring, Sumber Deling also provides a sign or an early warning system before Mount Semeru erupts. If the source of the spring turns white and smells of sulfur, the community believes that Mount Semeru will erupt (Detik News, 2008). Residents also believe that the eruption of Mount Semeru leads to a bamboo forest. When the eruption of Mount Semeru erupts, the eruption will cause a loud explosion when it hits the bamboo forest. Thus, the surrounding community will immediately evacuate to a safe place. This local wisdom becomes a community weapon for disaster mitigation. The bamboo forest is guarded because, in addition to providing a source of water for people's lives, it also serves as an early warning system that can save the community.

### **3.5 Social Capital Linking**

In addition to horizontal social bonding and bridging capital, social linking capital is also very important. The government also plays a major role in efforts to deal with natural disasters. It is important that the community has confidence that when a disaster occurs, no party will exploit the vulnerabilities of other parties and that local officials will be able to help people affected by the disaster (Jovita et al., 2019). Apart from the government, there is also participation from civil society organizations (CSOs), non-governmental organizations (NGOs), and the private sector, which provides assistance to disaster victims (Jovita et al., 2019). It is important for CSOs and the government to utilize social capital to increase community resilience when dealing with natural disasters (Sadeka

et al., 2015).

To persuade members of a group, we must share interpretations of the plan using terms that are understood by group members. For example, with a certain style of speech, one can use various powers such as the ability of a leader or a certain status (Littlejohn & Foss, 2005). The government can work together with those who have power in a group to invite the group to support the government's plan. In accordance with the character of the Javanese people, who respect their parents or village elders, the government can invite the Sumbermujur Village elders to work together in disaster management efforts. If the community believes in the government, it will be easier for the government and local communities to work together to deal with natural disasters.

For example, in response to calls for people to evacuate immediately when Mount Semeru begins to erupt, the government's role is to provide evacuation routes and safe evacuation posts. One of the evacuation posts is the Sumbermujur Village Hall, Candipuro District, Lumajang Regency. During the 2021 Mount Semeru eruption disaster, the local community was willing to live in refugee camps. Even though the evacuation center appeared quiet from morning to noon because evacuees left to do other things and only returned at night (Tvonenews.com, 2021). At least one disaster mitigation effort has been successfully carried out. Early evacuation can save many lives.

Social capital must be owned by all existing communities, so it is not only owned by the community of disaster survivors (Afdilla, 2019). Disaster survivors already have experience dealing with natural disasters. But natural disasters will continue to occur throughout history, often unforeseen, and anyone can fall victim to them. Therefore, the whole community needs to gain knowledge about disaster management efforts, including young people. As part of a disaster mitigation effort at the school student level, the concept of social capital must also be disseminated in schools. School resilience in the face of disasters is determined by the conditions of students and teachers at school. Dwiningrum's research et al. (2017) in a high school close to the volcanic eruption site in Bantul and a high school close to the earthquake site in Sleman showed that the concept of social capital was not well understood by students, but students realized the need for interaction and cooperation when a disaster occurred. Efforts that students can make when a disaster occurs are to save themselves, their families, the people around them, and their valuables; look for evacuation routes; seek appropriate shelter; and look for close family.

#### **4. CONCLUSIONS**

Natural disasters will continue to occur throughout history. Disaster survivors have experience dealing with disasters. However, the community also needs to have social capital to deal with disasters. The people of Sumbermujur Village have local wisdom, namely the existence of a bamboo forest that surrounds the Sumber Deling spring. The Sumber Deling spring is an early warning system where, if the water is white, then an eruption of Mount Semeru will occur soon. The bamboo forest is also an early warning system because the eruption of Mount Semeru will cause a loud explosion when it hits

the bamboo forest, so that the community will immediately save itself. In addition to local wisdom, trust in the government is also important in efforts to deal with natural disasters. The people of Sumbermujur Village, who are prone to the effects of the eruption of Mount Semeru, are Javanese people who still respect village elders. Both the government and CSOs, NGOs, and other private sectors can work with local village elders to gain the trust of the community. It is hoped that by building trust between the community, the government, and various other parties, social capital linking will become a more effective disaster management effort. Disaster mitigation efforts also need to be disseminated in schools so that the younger generation can become a generation that is resilient in dealing with disasters.

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