

The Influence of Earthquakes, Volcanic Eruptions, and Land Drought on the Social Conditions of Village Communities

Abstract

Disasters harm various aspects of life. This research aims to determine the negative impact of natural disasters on the social aspects of society. The data used in this research comes from 2021 Podes data and the 2022 and 2023 Social Resilience Index. The method used in this research is multiple linear regression. The results of this research indicate that natural disasters harm social aspects. Of the three independent variables in this study, it is known that volcanic eruptions have the most resounding significant adverse impacts one year and two years later. For this reason, an extra role is needed from the government to carry out evacuations when a disaster occurs and mitigate from the start to minimize negative impacts.

Comment [PNS1]: You may include Cyclone also in this. I suppose, land drought definition does not include cyclone, storm, tempest, hurricane, tempest, tornado etc. and hence.

Comment [PNS2]: If the focus of the study is restricted to Indonesia, suggest the country name to be part of the title

Comment [PNS3]: Adverse impacts does happen with immediate effect majorly.

I. Introduction

Social factors play a significant role in shaping and directing people's lives (A. Alam, 2022; Bandura, 2006; Haslam et al., 2021). Along with human growth and development, social aspects have become the main foundation in determining how individuals interact, develop, and adapt to their surrounding environment. The importance of social factors is evident in all aspects of daily life. This can be seen in how society forms norms, values, and systems that regulate relationships between individuals. For example, the social standards prevailing in a community can significantly influence individual behavior. More than that, social factors also influence group dynamics, communication patterns, and how conflicts are resolved in society (Bercovitch, 2019; Morrison-Smith & Ruiz, 2020; Tørring et al., 2019).

Social factors can also be seen in developing a person's social identity (Godinić & Obrenovic, 2020; Muldoon et al., 2019; Scheepers & Ellemers, 2019). Individuals not only form their identities from personal characteristics but also from their interactions with the surrounding environment. The values, beliefs, and behaviors they have are often influenced by the culture and social environment in which they live. In addition, social factors also have a significant impact in influencing individuals' access to resources and opportunities. Social inequalities can arise due to differences in economics, education, or social status, affecting access to health services, employment, and education (Alcaraz et al., 2020; Cogburn, 2019; Raghupathi & Raghupathi, 2020).

The social conditions of a society are often vulnerable to threats from internal and external factors (Nerubasska et al., 2020; Ojala et al., 2021; Shokry et al., 2022). In the social structure of society, disturbances can arise from within the community itself or originate from external factors, such as economic pressure, political change, or internal conflict between groups. These internal threats can result in instability that affects relationships between individuals and overall social dynamics. In addition, social conditions can also be affected by disturbances from environmental factors, including climate change. When drastic weather changes occur, such as floods, droughts, or other natural disasters, people's living arrangements can be seriously disrupted (Benevolenza & DeRigne, 2019; Islam & Khan, 2020; Kelman, 2020).

Natural disasters often cause infrastructure damage, loss of resources, and disruption of people's daily living patterns, which can affect social interactions, well-being, and economic stability. (Raihan, 2023; Spoon et al., 2020; Wassie, 2020). Climate change can also give rise to more significant social conflict, especially regarding access to increasingly limited resources, such as water and agricultural land. This can trigger competition and tension between individuals or groups of society, even at a more comprehensive level, such as conflicts between countries.

As a country located in the Pacific Ring of Fire, Indonesia is often the center of attention due to several natural disasters that occur periodically. Among the natural disasters that often hit Indonesia, earthquakes, volcanic eruptions, and drought are some of them that usually have a considerable impact.

Earthquakes are one of the natural disasters that often occur in Indonesia because of its geographic location at the meeting point of tectonic plates. Earthquakes often cause severe damage to infrastructure and loss of life. Volcanic eruptions are also a serious threat, especially in areas with active volcanoes such as Mount Merapi and Mount Sinabung. This eruption can result in hot clouds, lava, and ashfall, potentially damaging the environment and threatening nearby residents' safety. Apart from that, Indonesia also experiences drought problems, which often impact the agricultural sector and the availability of clean water. A long dry season can cause a shortage of water supply for irrigation of crops and people's daily needs.

These natural disasters show how important mitigation and emergency management efforts are in dealing with emergencies. The government and society must prepare, preventively and responsively, by developing resilient infrastructure, strengthening early warning systems, and providing assistance and support for disaster victims.

Rural areas are often vulnerable to natural disasters (Hallegatte et al., 2020; Sarker et al., 2019). This is caused by several factors, one of which is the topography or geographical characteristics of the area. In general, villages tend to have a large land area with a wide geographic diversity, from lowlands to mountain slopes. This diverse topography can cause various types of natural disasters. For example, rural areas on mountain slopes are vulnerable to landslides due to unstable ground pressure. Changes in rainfall or earthquake activity could be the main trigger for landslides in the area. Apart from that, places in the lowlands can experience flooding during the rainy season due to inadequate drainage systems or rivers overflowing due to high rainfall. Not only that, rural areas often experience drought, especially during the dry season. Sizeable agricultural land in rural areas depends on rainfall as the primary water source. When the dry season arrives, water shortages can cause crop failure and difficulty accessing clean water for daily needs.

Natural disasters in rural areas pose challenges due to limited access to emergency services, inadequate infrastructure, and limited emergency resources. Therefore, the government and local communities need to develop effective disaster mitigation strategies and build community resilience to natural disasters by considering the geographical characteristics of rural areas. These efforts include providing an early warning system, disaster risk mapping, and building disaster-resistant infrastructure to reduce the impact caused by natural disasters in rural areas.

Many studies have examined the impact of natural disasters on financial losses (Abbas Khan et al., 2019; A. S. A. F. Alam et al., 2020; Ali et al., 2020; Panwar & Sen, 2019). However, there is still limited research that examines the social impact. Therefore, this research aims to analyze the effects of natural disasters on social resilience in rural areas. It is suspected that natural disasters significantly negatively influence social aspects of society, especially in rural areas.

Comment [PNS4]: If the Scholar wants to examine the impact on rural areas of Indonesia only, suggest the country name to be included in Title.

II. Data and Methodology

This research uses natural disaster data from the 2021 Village Potential (Podes) data collection, sourced from the Central Statistics Agency. The natural disaster data analyzed in this research are earthquakes, volcanic eruptions, and drought. This research also uses Social Resilience Index (IKS) data for 2022 and 2023 obtained from the Ministry of Villages, Development of Disadvantaged Regions and Transmigration. The indicators used in calculating IKS are as follows:

1.	Access to Health Facilities	13.	Access to Skills Center/Courses	25.	Conflict
2.	Doctor	14.	Availability of Community Reading Gardens/Village Libraries	26.	People with Social Welfare Problems
3.	Midwife	15.	Mutual Cooperation Habit	27.	Access Special Schools
4.	Other Health Workers	16.	Frequency of Mutual Cooperation	28.	Electrical Access
5.	BPJS membership	17.	Existence of Public Space	29.	Cell Phone Signal
6.	Access to Poskesdes	18.	Sports Activities Group	30.	Internet Network
7.	Posyandu activities	19.	Sports Activities	31.	Citizen Internet Access
8.	Access to SD/MI	20.	Religious Diversity	32.	Toilet Access
9.	Access to SMP/MTS	21.	KeragamanBahasa	33.	Rubbish
10.	Access to high school/vocational school	22.	Language Diversity	34.	Drinking water
11.	Availability of PAUD	23.	Communication Diversity	35.	Bathing & Washing Water
12.	Availability of PKBM/ABC Package	24.	Patrol	36.	Conflict

The matching data between 2021 natural disaster data and IKS data showed that the number of observations was 2,892 villages in 2022 and 2,820 villages in 2023. The number of village samples was spread across all provinces in Indonesia and divided into categories of village progress levels. This research uses multiple regression analysis (OLS). The dependent variable in this research is the Social Resilience Index (IKS), while the variables used are the number of earthquakes, volcanic eruptions, and drought (land).

Comment [PNS5]: Is it also possible to give number of Eq, Volcano, Drought episodes year-wise and village category-wise which can give better picture?. If that is linked to Resilience index, that may give better picture. Just a suggestion to better the clarity.

III. Results and Discussion

From the regression results, information is generally obtained that natural disasters harm the social resilience index. Natural disasters often significantly negatively impact various social aspects in a society. One of the most visible impacts is mental and psychosocial health. Conditions of stress, anxiety, trauma, and depression often increase sharply after a natural disaster occurs. Individuals who are victims or witnesses of disasters often experience fear of loss, concern about the future, and difficulty adapting to rapid changes after a disaster. This can affect overall mental well-being and requires ongoing support efforts from the community and mental health facilities.

Apart from that, natural disasters can also disrupt social networks and togetherness in society. Losing family members, neighbors, and close friends can affect social relationships. Sometimes, natural disasters separate people from their community networks, resulting in isolation and loneliness. In addition, basic needs such as shelter, clean water, and food become scarce after a disaster, which can trigger competition and conflict among communities to obtain limited resources.

Table 1. The Impact of Natural Disasters in 2020 on the Social Resilience Index in 2022

Natural Disasters (2020)	Coefficient	Significance
Earthquake	-0.0085531	0.000
Erupting volcano	-0.0181675	0.064
Drought (Land)	-0.0087538	0.141
Constant	0.7480031	0.000

Note: Dependent Variable: Social Resilience Index
Independent Variable: Earthquake, Volcano Eruption, and Drought (Land)

Based on Table 1, it is informed that earthquakes and volcanic eruptions in 2020 had a negative and significant effect on the social resilience index in 2022. Volcanic eruptions had the most resounding negative impact compared to other research variables.

Table 2. The Impact of Natural Disasters in 2021 on the Social Resilience Index in 2022

Natural Disasters (2021)	Coefficient	Significance
Earthquake	-0.0085589	0.000
Erupting volcano	-0.0520880	0.000
Drought (Land)	-0.0131623	0.097
Constant	0.7472388	0.000

Note: Dependent Variable: Social Resilience Index
Independent Variable: Earthquake, Volcano Eruption, and Drought (Land)

Based on Table 2, it is informed that earthquakes, volcanic eruptions, and drought (land) in 2020 have had a negative and significant effect on the social resilience index in 2022. Volcanic eruptions have the most resounding negative impact compared to other research variables.

Table 3 shows that the majority of research observations were in developing villages. This result is under the distribution of village conditions currently in Indonesia. There are 6.40 percent who have independent status, 21.89 percent who have an advanced level, 50.62 percent who have a developing situation, 15.35 percent who have underdeveloped status, and 5.74 percent who have very underdeveloped status.

Table 3. Number of Observation Villages According to Development Classification in 2022

Development Village Index Status (2022)	Frequency	Percent
Independent	185	6.40
Proceed	633	21.89
Develop	1,464	50.62
Left behind	444	15.35
Very Left behind	166	5.74
Total	2.892	100.00

Table 4. The Impact of Natural Disasters in 2020 on the Social Resilience Index in 2023

Natural Disasters (2020)	Coefficient	Significance
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Earthquake	-0.0095753	0.000
Erupting volcano	-0.0172796	0.000
Drought (Land)	-0.0116607	0.048
Constant	0.7605128	0.000

Note: Dependent Variable: Social Resilience Index
Independent Variable: Earthquake, Volcano Eruption, and Drought (Land)

Based on Table 4, it is informed that earthquakes, volcanic eruptions, and drought (land) in 2020 have had a negative and significant effect on the social resilience index in 2022. Volcanic eruptions have the most resounding negative impact compared to other research variables.

Table 5. The Impact of Natural Disasters in 2021 on the Social Resilience Index in 2023

Natural Disasters (2021)	Coefficient	Significance
Earthquake	-0.0097142	0.000
Erupting volcano	-0.0370195	0.000
Drought (Land)	-0.0211696	0.011
Constant	0.7597123	0.000

Note: Dependent Variable: Social Resilience Index
Independent Variable: Earthquake, Volcano Eruption, and Drought (Land)

Based on Table 5, it is informed that earthquakes, volcanic eruptions, and drought (land) in 2020 have had a negative and significant effect on the social resilience index in 2022. Volcanic eruptions have the most resounding negative impact compared to other research variables.

Table 6. Number of Observation Villages According to Development Classification in 2023

Development Village Index Status (2023)	Frequency	Percent
Independent	368	13.05
Proceed	731	25.92
Develop	1,277	45.28
Left behind	297	10.53
Very Left behind	147	5.21
Total	2,820	100.00

Based on Table 6, it is informed that the majority of research observations were in developing villages. This result follows the distribution of village conditions currently in Indonesia. 13.05 percent have an independent status, 25.92 percent have an advanced level, 45.28 percent have a developing situation, 10.53 percent have an underdeveloped status, and 5.21 percent have a very underdeveloped status.

Based on the regression results above, almost all variables significantly negatively influence the social resilience index. Of the three independent variables in this study, it is known that volcanic eruptions have the most resounding significant adverse impacts one year and two years later. The results align with several previous studies which stated that natural disasters negatively impact society's social conditions (Kaniasty, 2020; Rosselló et al., 2020). For this reason, an extra role is needed from the government to carry out evacuations when a disaster occurs and mitigate from the start to minimize negative impacts.

Comment [PNS6]: Explain how. Because, immediate adverse impact of volcano is also more. No doubt that, the areas affected by volcanic eruption render the land unusable for agriculture etc.

IV. Conclusion

Natural disasters harm various aspects of life, including parts of social resilience. Social elements that have been formed sometimes have to disappear due to natural disasters. So, areas affected by natural disasters need to be rebuilt to make them available again and used by the community. It takes a relatively long time to reorganize various aspects affected by natural disasters. This research shows that the impact of natural disasters can still be felt up to 2 years after the disaster occurs. For this reason, the role of the government is needed to accelerate recovery from the impact of natural disasters. Besides that, disaster mitigation is necessary to minimize the negative impacts of natural disasters.

Comment [PNS7]: Add couple of points to give more clarity.

Comment [PNS8]: Examine availability of statistics such as number of deaths, deaths of sole earning members in the family, number of families losing their land due to natural calamities etc- This should be if possible category-wise like Rich, Middle Class, Poor, Very Poor etc. This is just a suggestion to improve the impact of the study.

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