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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.

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.

⁴ 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.

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:

| Social Resilience Indicators | | | | | |
|------------------------------|--|-----|--|-----|-------------------------------------|
| 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. | Keragaman Bahasa | 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).

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 |
|--------------------------|-------------|--------------|
| 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.

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.

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