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The Impact of Natural Disasters on Village Development

Abstract

Disasters harm various aspects, including regional development. This research aims to determine the negative impact of natural disasters on the development of rural areas. The data used in this research comes from Podes 2021 data and the 2022 and 2023 Developing Village Index. The method used in this research is multiple linear regression. This research indicates that natural disasters harm economic aspects and lead to village development. Of the three independent variables in this study, it is known that volcanic eruptions and drought (land) have the deepest significant negative impact one year and two years after the event. 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 the negative impacts caused.

I. Introduction

Development, in a social, economic, and infrastructure context, is an important indicator in assessing the success of a region. This is closely related to a region's ability to improve its population's overall quality of life (Aman et al., 2022; Erdin & Ozkaya, 2020; Prus & Sikora, 2021). When an area succeeds in experiencing significant development, this reflects the success of the government and society in improving various aspects of life. Social development includes increasing access to education, health, and social welfare. A region that is successful in social development usually has equitable and quality education services for all levels of society. In addition, adequate health facilities and access to affordable medical services are important indicators of a region's social progress. Economic development is also a key element in assessing the success of a region. When a region's economy grows, more jobs are created, people's income increases, and the community's economic welfare increases (Bartik, 2020; Chollisni et al., 2022; Ndubisi et al., 2021). Developed infrastructure, such as good transportation networks, modern trade centers, and sustainable Investment, advance a region's economic growth. (Li et al., 2023; Quium, 2019; Saidi et al., 2020).

Apart from that, environmental aspects are also an important part of sustainable development. The success of a region in maintaining a balance between economic development and environmental protection reflects its commitment to sustainability. The availability of well-maintained natural resources and sustainable environmental policies are important factors in sustainable development (Li et al., 2023; Nekmahmud & Fekete-Farkas, 2021; Yahman & Setyagama, 2023).

The government is responsible for carrying out development missions in various areas of community life. One aspect that receives special attention is economic development because it has a very important role in measuring the progress of a region. Improving a region's economy includes growth in gross domestic product (GDP) and job creation, equal income distribution, and overall community welfare improvement. (Dahliah & Nur, 2021; Diemer et al., 2022; Paul et al., 2021).

With the policies and programs they design, the government seeks to encourage sustainable economic growth. These steps involve developing adequate infrastructure, supporting potential economic sectors, promoting Investment from both within and outside the country, and making policies that support business actors, especially small and medium businesses.

The government's efforts to encourage economic growth also include providing training and education relevant to the job market's needs. This aims to improve the quality of human resources, which is one of the key factors in the economic progress of a region. The government also tries to create a conducive business environment by providing facilities, incentives, and supportive regulations for economic actors (Jang et al., 2020; Mombeuil, 2020; Ufua et al., 2020).

Economic development carried out by the government does not only involve short-term steps, but also pays attention to long-term sustainability aspects. Government efforts to build a sustainable economy must also align with environmental conservation principles and wise management of natural resources (Andriansyah et al., 2021; Dama et al., 2021; Olalekan et al., 2019).

The development process of a region does not always run smoothly but is often faced with several negative aspects that can hinder or even slow down the acceleration of development. One of the negative aspects that often arises is the existence of social conflicts, both internal between local communities and those rooted in external tensions. Conflicts like this can disrupt regional stability and hinder the progress of ongoing development projects.

Environmental problems are also a negative aspect that often hinders the development process (Ouyang et al., 2020; Qaim, 2020; Tawalbeh et al., 2021). Unsustainable or environmentally unfriendly development can cause environmental degradation, loss of natural habitat, and hurt natural resources (Ajibade et al., 2021; Nathaniel et al., 2021; Wassie, 2020). Ignoring environmental aspects can hinder long-term development because of its negative impact on ecosystems and human health. Not only social conflict and environmental problems but also security instability, corruption, lack of adequate infrastructure, and policies that are ineffective or not in line with community needs are other negative factors that can slow down the development process. When things like this are not addressed properly, the region will find it difficult to reach its full potential in developing various sectors of life.

One factor that has a big impact on the acceleration of development is the occurrence of natural disasters. Natural disasters such as earthquakes, floods, landslides, tropical storms, forest fires, and tsunamis can disrupt and even hinder the development progress of a region. The impact of natural disasters can be very destructive, resulting in material loss, loss of human life, and serious environmental damage. When natural disasters occur, infrastructure that has been painstakingly built can be seriously damaged or even destroyed, including homes, roads, health and educational facilities. Additionally, natural disasters often disrupt supplies of clean water, electricity, and other essential services, resulting in major hardship for affected populations.

Natural disasters and direct losses incurred can hamper long-term development efforts (Cui et al., 2021; Finucane et al., 2020; Panwar & Sen, 2019). The post-disaster reconstruction and recovery process requires significant time, resources, and funds, which can hamper Investment and other development projects. Additionally, when a region is continually exposed to natural disasters, this can affect investor confidence and long-term economic growth (Abbas Khan et al., 2019; Amarasinghe et al., 2020; Atsalakis et al., 2021).

Natural disasters are often closely related to climate factors because climate change can trigger events such as floods, droughts, storms, and other natural phenomena (Ali et al., 2020; Dey & Lewis, 2021; Koubi, 2019). The climate changes that occur can increase global temperatures, irregular rain patterns and higher storm intensity. This has a significant impact on the social, economic, and environmental conditions of society.

Increasing global temperatures can result in extreme weather, such as prolonged heat waves or drastic changes in rainfall patterns (AghaKouchak et al., 2020; Alimonti et al., 2022; Naveendrakumar et al.,

2019). This condition can impact agricultural production and water availability, affecting food security and the community's economy. On the other hand, prolonged drought can damage crops, cause food scarcity, and increase the risk of forest fires.

Increased intensity of tropical storms, floods, and landslides are also impacts of climate change, which can cause large material losses, infrastructure damage, and loss of human life. The psychological and social impacts of natural disasters are also often very severe, disrupting the daily lives and mental well-being of affected communities.

Natural disasters are events that often result in extensive damage, both physical and non-physical. The physical damage from natural disasters can be widespread and destructive, including destroying bridges, roads, buildings, and health and educational facilities. Floods, earthquakes, tropical storms, and volcanic eruptions are natural disasters that can cause serious and detrimental physical damage. (Chaudhary & Piracha, 2021; Teh & Khan, 2021; Wei, 2021).

Apart from physical damage, natural disasters can also have a significant impact in the form of non-physical damage. One of the most pronounced non-physical impacts is the psychological and emotional losses experienced by disaster victims. Natural disasters often cause deep feelings of trauma, anxiety, and stress for those affected. Loss of family members, shelter, livelihood, and uncertainty about the future can burden disaster victims with a heavy emotional burden.

Natural disasters can also cause non-physical damage in economic and social terms besides psychological impacts. Loss of livelihood, economic loss, and difficulty in accessing basic services such as clean water, food, and health services are non-physical impacts that often occur after natural disasters. Natural disasters can also result in social changes in society, such as family separation, forced migration, or changes in social structures.

Damage caused by natural disasters often takes a long time to repair and restore (Rouhanizadeh et al., 2020; Sun et al., 2020; Zheng et al., 2021). This selection process involves various stages requiring various parties' collaborative efforts, including the government, humanitarian agencies, volunteers, and local communities.

In the early stages of a natural disaster, the main focus is often on providing emergency assistance, such as temporary shelter, food, clean water, medical services, and other basic needs for victims. Saving lives and meeting urgent needs is a top priority to reduce the impacts caused by disasters. After the emergency phase, a short-term recovery begins with efforts to clean up the remains of the disaster, restore access to public facilities, and improve basic infrastructure such as roads, electricity, and clean water. This step allows people to return to carrying out their activities more normally.

Long-term recovery after natural disasters is often more complex. This involves reconstructing damaged infrastructure, restoring livelihoods, and developing more resilient plans to reduce vulnerability to future disasters. Psychological improvement, economic recovery, and preparedness planning to face future disasters are also important parts of the long-term recovery process.

Recovery from damage caused by natural disasters requires time, patience, and ongoing commitment from the various parties involved. Collaboration between government, humanitarian agencies, volunteers, and local communities ensures a comprehensive recovery process. In facing the recovery process, it is important not only to focus on physical improvement but also to pay attention to psychological, economic, and social aspects so that the affected community can recover.

Many studies have examined the impact of natural disasters on financial losses and casualties (Coronese et al., 2019; Markhvida et al., 2020; Ocal, 2019). However, there are still limited studies on

the impact of natural disasters on the acceleration of development. Therefore, the research aims to analyze the impact of natural disasters on the development of rural areas. This research focuses on rural areas because, with all their existing limitations, they have the potential for deep negative impacts due to natural disasters.

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 Economic Resilience Index (IKE) data for 2022 and 2023 obtained from the Ministry of Villages, Development of Disadvantaged Regions and Transmigration. The analysis continues with the impact of natural disasters on village development. Village development indicators (IDM) are obtained by integrating the Social Resilience Index, Environmental Resilience Index, and Economic Resilience Index (IKE).

The matching data between 2021 natural disaster data and IKE and IDM 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 village progress level categories. This research uses multiple regression analysis (OLS). The dependent variables in this research are the Economic Resilience Index (IKE) and the Village Development Index (IDM). In contrast, the variables used are the number of earthquakes, volcanic eruptions, and drought (land).

III. Results and Discussion

The results of the regression analysis show a significant relationship between natural disasters and a decrease in the economic resilience index, which in turn impacts overall village development. Natural disasters often have detrimental consequences for the economic stability of a region. For example, floods, earthquakes, or tropical storms can cause major losses to local economic sectors, such as agriculture, tourism, infrastructure, and trade.

The economic resilience index refers to a region's ability to recover and adapt after a natural disaster. If the region has low economic resilience, the impact of the disaster will be more severe and prolonged. For example, large losses in the agricultural sector can result in food scarcity and reduced income for residents, ultimately slowing down the village development process.

In addition, natural disasters often cause infrastructure damage that affects accessibility to essential services such as health, education, and transportation. This can hinder the progress of village development because it reduces the accessibility and availability of basic services needed by the community.

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

Natural Disasters (2020)	Coefficient	Significance
Earthquake	-0.0101214	0.000
Erupting volcano	-0.0255269	0.000
Drought (Land)	-0.0212394	0.012
Constant	0.5691054	0.000

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

Based on Table 1, it is informed that earthquakes, volcanic eruptions, and drought (land) in 2020 had a negative and significant effect on the economic resilience index in 2022. Volcanic eruptions had the deepest negative impact when compared to other research variables.

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

Natural Disasters (2021)	Coefficient	Significance
Earthquake	-0.0094766	0.000
Erupting volcano	-0.0444215	0.001
Drought (Land)	-0.0245874	0.034
Constant	0.5675169	0.000

Note: Dependent Variable: Economic 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 a negative and significant effect on the economic resilience index in 2022. Volcanic eruptions have the deepest negative impact when compared to other research variables.

Based on Table 3, it is shown that the majority of research observations were in developing villages. This result follows the distribution of village conditions currently in Indonesia. There are 6.40 percent who have independent status, 21.89 percent have advanced status, 50.62 percent have developing status, 15.35 percent have underdeveloped status, and 5.74 percent 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 shows that the earthquake and drought (land) in 2020 had a negative and significant effect on the Economic Resilience Index in 2022. Drought (land) had the deepest negative impact compared to other research variables.

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

Natural Disasters (2020)	Coefficient	Significance
Earthquake	-0.0107400	0.000
Erupting volcano	0.0010295	0.934
Drought (Land)	-0.0208831	0.020
Constant	0.5991143	0.000

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

Based on Table 5, it is informed that earthquakes and volcanic eruptions in 2020 have a negative and significant effect on the Economic Resilience Index in 2022. Volcanic eruptions have the deepest negative impact when compared to other research variables.

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

Natural Disasters (2021)	Coefficient	Significance
Earthquake	-0.0106120	0.000
Erupting volcano	-0.0168478	0.038
Drought (Land)	-0.0178387	0.198
Constant	0.5976449	0.000

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

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. There are 13.05 percent who have independent status, 25.92 percent have advanced status, 45.28 percent have developing status, 10.53 percent have underdeveloped status, and 5.21 percent have very underdeveloped status.

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

Table 7. The Impact of Natural Disasters in 2020 on the 2022 Village Development Index

Natural Disasters (2020)	Coefficient	Significance
Earthquake	-0.0071658	0.000
Erupting volcano	-0.0233744	0.000
Drought (Land)	-0.0158593	0.003
Constant	0.6664697	0.000

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

Based on Table 7, it is informed that earthquakes, volcanic eruptions and drought (land) in 2020 have a negative and significant effect on the Economic Resilience Index in 2022. Volcanic eruptions have the deepest negative impact when compared to other research variables.

Table 8. The Impact of Natural Disasters in 2021 on the 2022 Village Development Index

Natural Disasters (2021)	Coefficient	Significance
Earthquake	-0.0069668	0.000
Erupting volcano	-0.0469356	0.000
Drought (Land)	-0.0147863	0.065
Constant	0.6653330	0.000

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

Based on Table 8, it is informed that earthquakes, volcanic eruptions and drought (land) in 2021 have a negative and significant effect on the Economic Resilience Index in 2022. Volcanic eruptions have the deepest negative impact when compared to other research variables.

Table 9. The Impact of Natural Disasters in 2020 on the 2023 Village Development Index

Natural Disasters (2020)	Coefficient	Significance
Earthquake	-0.0091368	0.000
Erupting volcano	-0.0034792	0.555
Drought (Land)	-0.0132460	0.032
Constant	0.6917701	0.000

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

Table 9 indicates that the earthquake and drought (land) in 2020 had a negative and significant effect on the Economic Resilience Index in 2023. Drought (land) had the deepest negative impact compared to other research variables.

Table 10. The Impact of Natural Disasters in 2021 on the 2023 Village Development Index

Natural Disasters (2021)	Coefficient	Significance
Earthquake	-0.0088265	0.000
Erupting volcano	-0.0057566	0.582
Drought (Land)	-0.0145111	0.099
Constant	0.6906487	0.000

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

Based on Table 10, it is informed that earthquakes and drought (land) in 2021 will have a negative and significant effect on the Economic Resilience Index in 2023. Drought (land) has the deepest negative impact compared to other research variables.

Based on the regression results above, almost all variables significantly negatively influence the Economic Resilience Index. Of the three independent variables in this study, it is known that volcanic eruptions and land drought have the deepest significant negative impact one year and two years later. The results align with several previous studies which stated that natural disasters negatively impact the economic conditions of society and regional development (Panwar & Sen, 2019; 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 hurt various aspects of life, including aspects of social resilience. Social aspects 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 needed to minimize the negative impacts of natural disasters.

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