

STRENGTHENING THE RESILIENCE OF THE NORTHERN COASTAL AREA OF SUMBAWA ISLAND THROUGH EARTHQUAKE AND TSUNAMI DISASTER MITIGATION

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ABSTRACT: This research aims to analyze efforts to strengthen the resilience of community areas on the north coast of Sumbawa and Satonda island, Nusa Tenggara Barat Province in efforts to mitigate natural disasters. This research is descriptive qualitative research. Data collection was carried out using non-participatory observation methods, in-depth interviews and documentation aimed at people living on the north coast of Sumbawa Island and Satonda island which directly face the Flores Sea. The research results show that the resilience of the northern coastal area of Satonda Island is classified as vulnerable because the local community does not yet understand the potential for earthquakes and tsunamis and disaster mitigation aspects have not been a priority agenda for the local government. People who live on the coast do not receive socialization and knowledge about natural disaster mitigation. Thus, the resilience of the community area to face natural disasters is still relatively weak, so there is a high risk of negative impacts from these natural disasters.

Key: national resilience, social resilience, disaster mitigation, earthquake, tsunami

1.INTRODUCTION

Indonesia is a country with a high level of natural disaster vulnerability. This is due, in part, to Indonesia's position in the Pacific Ring of Fire, especially in eastern Indonesia. The 2022 World Risk Report released by Bündnis Entwicklung Hilft and IFHV of the Ruhr-University Bochum shows that Indonesia is the third most disaster-prone country in the world[1]. According to Marwanta (2005), The eastern region of Indonesia consists of three large active plates, namely the Eurasian plate, the Indo-Australian plate and the Pacific plate. The movement of these three plates has an impact on the intensity and vulnerability to natural disasters such as active volcanoes, earthquakes and tsunamis. Earthquakes are a natural disaster that occurs quite often in Indonesia [3].

Several earthquakes and tsunamis that occurred in Aceh, Padang, Palu, Lombok, Banten, and several other areas, especially in the southern region of the island of Java, which occurred in the last two decades, have caused physical damage and claimed many lives and material losses invaluable. Such as Tsunami of Palu, It is thought to have been caused by seabed landslides as the source of the force that caused the tsunami [4]. Meanwhile, the tsunami in Banten is thought to be the impact of a seabed landslide that occurred due to the influence of the eruption of Mount Anak Krakatau [5].

Likewise with the tsunami earthquake in Aceh and Yogyakarta which of course needs to be a lesson to minimize the impact of disasters.

Area of Sumbawa and Satonda island in Province of West Nusa Tenggara Become a disaster-prone area because it is directly facing the sea of flores. Based on data of BNPB [6] states that the Lombok and Sumbawa regions, have a high category disaster prone index. Sumbawa island consist of three district which are District of Bima, Dompu and Sumbawa Besar which included in the province of West Nusa Tenggara (NTB). Sumbawa Island is bordered by Lombok Island to the West, Flores/Komodo Island to the East, Flores Sea to the North and Indian Ocean to the South.

Based on the results of historical research, on December 12, 1992 a large earthquake and tsunami devastated the northern part of Flores Island to East Flores. The 7.8 magnitude earthquake claimed at least 2,100 lives, destroyed 18,000 houses and other vital locations with the worst damage occurring in the city of Maumere [7]. Later, earthquakes of moderate magnitude shook the region several times. In July 2018, a 6.4 magnitude earthquake shook and devastated Lombok Island and its surroundings including Sumbawa Island, although the damage was relatively minor. After the Lombok earthquake, the Sumbawa Island region was also shaken by an earthquake with a magnitude of 5.4. Then most recently on April 29, 2023, a magnitude 5.7 earthquake shook the Bima

region. The series of earthquakes was not followed by a tsunami, which was the most feared by the community. Although the north coast of Sumbawa is not the main epicenter of the earthquake, this earthquake disaster needs to be watched out for, especially for people who live on the north coast because it is directly facing the Flores sea and is in the epicenter vortex of the earthquake. This is because the destructive power caused by this natural phenomenon can even destroy human civilization [3].

Previous studies on the potential and mitigation of earthquakes and tsunamis were generally conducted in the waters of Lombok and Flores, so there are few studies that address the potential of earthquakes and tsunamis on the north coast of Sumbawa Island. Research conducted in the coastal areas of Flores and Lombok islands also focuses on the probability of areas being severely affected if earthquakes and tsunamis occur. The first research was conducted by Marchiavelly, et al from the Geospatial Information Agency on disaster mapping in West Lombok. The results of his research state that the potential disaster that has the highest risk is a tsunami. Further research conducted by Kusnadi, et al [8] on the role of NTB geologists in geological disaster mitigation. Kusnadi, et al stated that as an area with high natural disaster vulnerability, NTB geologists need to make efforts to mitigate natural disasters including volcanic eruptions, earthquakes/tsunamis, landslides and land subsidence. Further research by Priyobudi, et al [9] which examines the indication of a rising fault in Plampang, Sumbawa based on the analysis of the 2020 earthquake. This research reveals the existence of a relatively shallow active fault that poses a threat to Sumbawa Island if a maximum magnitude earthquake at shallow depth occurs in the future.

Given the considerable threat of earthquake and tsunami disasters in Sumbawa, it is necessary to conduct an in-depth study of natural disaster mitigation efforts by the community in the face of earthquake and tsunami disasters and analyze the resilience of the region. Resilience means the ability of a person or group to survive in the face of a disturbance. Regional resilience is the ability of the community to maintain stability, cohesion, and security in the face of all forms of pressure or threats, including the threat of environmental changes due to natural disasters. Regional resilience is also not only seen as the ability to defend itself, but there is a process that can bring people to a better condition than before [10]. When the community is unable to survive, the condition that will occur is vulnerability so that it has the potential to become a victim of natural disasters.

Vulnerability conditions will cause losses in several aspects such as the destruction of buildings, infrastructure, facilities and infrastructure in a long period of time. Research on the condition of the

community's regional resilience is important because it can reflect the community's ability to adapt, transform, and collaborate in facing challenges that come from the external environment (Maclean *et al.*, (2014) dalam [11]. This research is important so that coastal communities have regional resilience to earthquake-tsunami threats, so that when earthquakes and tsunamis occur, the number of casualties and material damage should be minimized [12]. Furthermore, the study of the social capital capacity of the community in the region is also an interesting material to be studied as one of the dimensions of national resilience.

Therefore, it is necessary to strengthen regional resilience so that the community can face potential natural disasters that can occur on the north coast of Sumbawa Island with minimal impact. Thus, the results of this study are expected to provide policy recommendations to local governments and local communities regarding strategies to strengthen community territorial resilience in the face of natural disaster threats for the northern coastal communities of Sumbawa Island.

2.METHOD

This research is a type of qualitative method to examine the resilience of the northern coastal communities of Sumbawa Island in an effort to mitigate the tsunami earthquake disaster in Flores sea waters. The location of this research is in the north coastal area of Sumbawa Island, including the sub-districts of Pekat, Tambora, Labuan Badas, and Satonda Island. Data collection techniques were conducted through non-participatory observation, in-depth interviews, and documentation studies. Informants in the interviews were selected using non-probability sampling through the snowball sampling method. Informants in this research include: Head of Pekat Sub-District, Head of Nangamiro Village, former Head of Sebotok Village, guardian of Satonda Island, and people in several villages located and living along the north coast of Sumbawa Island.

3. RESULT AND DISCUSSION

Vulnerability and potential for natural disasters on the north coast of Sumbawa Island

An earthquake is a natural disaster event that is the result of tectonic and volcanic activity, namely the movement of the earth's surface, causing sudden and unpreventable movements [13]. This sudden and unpredictable event has caused the community to be inattentive to disasters and unprepared for them. Many buildings suffered moderate to severe damage as a result of the earthquake.

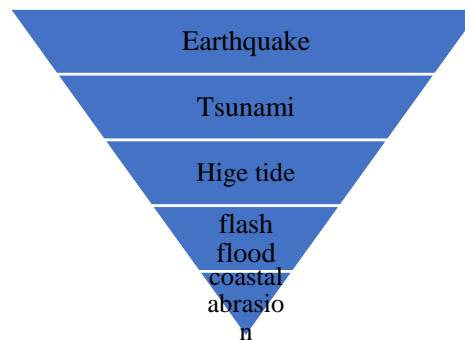
West Nusa Tenggara Province is one of the provinces with a high level of natural disaster vulnerability in Indonesia, which affects the resilience of the province with a population of around 5.32 million people [14]. The experience of the big earthquake and tsunami in Aceh in 2004 and the Lombok tsunami in 2018 can be a lesson for the community, especially the readiness to face these disasters. Every disaster in Indonesia has its own pattern and handling, but the number of victims is always in large numbers. This is different from Japan where victims can always minimize the number of casualties[15]. If the earthquake occurred in the northern region of Sumbawa Island, it is feared that a potential tsunami could threaten communities on the north coast of Sumbawa Island such as Calabai Village, Labuan Kananga, Labuan Badas Subdistrict on Moyo Island, and Medang Island. In addition, earthquake tremors and tsunami currents have the potential to damage the coral reef ecosystem on Satonda Island.

BPS has released the Indonesian Disaster Risk Index for each province in Indonesia in 2021, one of which is in the NTB region with the following risk levels:

Disaster Risk Index Province of West Nusa Tenggara									
No	district/city	2015	2016	2017	2018	2019	2020	2021	Risk Class of 2021
1	Sumbawa	150.00	150.00	150.00	150.00	150.00	150.00	150.00	High
2	Lombok Tengah	158.40	158.40	158.28	166.12	157.08	157.08	146.99	High
3	Lombok Barat	205.20	205.20	205.20	181.20	161.83	161.83	145.84	High
4	Lombok Timur	180.40	180.40	172.76	157.06	142.73	142.73	137.88	Middle
5	Bima	209.20	142.51	139.36	137.42	129.95	129.95	129.72	Middle
6	Sumbawa Barat	152.40	152.40	152.40	152.40	142.30	142.30	128.53	Middle
7	Dompu	184.40	128.23	123.12	111.36	111.36	111.36	107.21	Middle
8	Lombok Utara	152.40	152.40	139.00	120.62	106.91	106.91	94.50	Middle
9	Bima City	170.80	106.69	104.03	94.91	89.37	89.37	92.61	Middle
10	Mataram City	149.20	101.71	96.68	96.68	88.95	88.95	90.03	Middle

Table 1. Disaster Risk Index of West Nusa Tenggara
 Sources: BPS (2021)

The data above serves as a warning to the community, such as in the Sumbawa region as the area with the highest disaster risk, followed by Central Lombok and West Lombok. Bima and Dompu districts are in the medium category. Sumbawa, Bima and Dompu districts are located on the north coast of Sumbawa Island. The results of data collection show that several earthquakes occurred even though the epicenter of the earthquake was not on the island of Sumbawa. One of the worst was the Lombok earthquake in 2018 where the tremors were felt on the islands of Java and Bali[16]. The magnitude of the earthquake was felt quite lightly on Sumbawa Island, causing only minor damage, in contrast to the damage on Lombok Island, which was very severe because it was the epicenter of the earthquake. The results of data collection and processing in the field show several potential natural disasters that are prone to occur on the north coast of Sumbawa Island in order of the most at risk of occurrence, namely:



Picture 1. Potential natural disasters on the north coast of Sumbawa

Source: researcher procees

Then the results of the analysis based on the contours and geographical conditions of the area, researchers mapped several villages that have a high level of damage when natural disasters occur, namely:

- 1) Calabai village in Pekat subdistrict
- 2) Labuan Kananga village ini Tambora subdistrict
- 3) Labuan Barat village in Pekat subdistrict
- 4) Part of Labuan Badas subdistrict in Moyo island
- 5) part of Labuan Badas subdistrict ini Medang island.

Strengthening the Resilience of the North Coastal Region of Sumbawa Island

Regional resilience is the basic capital for the community as an effort to overcome various kinds of disturbances and difficulties including natural disasters such as the potential threat of earthquakes and tsunamis. Thus, the role of the government in implementing policies, strategies and programs on regional resilience is very important because regional resilience is one of the pillars of successful state development. The quality of the community's regional resilience in an area can be seen from the condition of the area, vulnerability to disasters, carrying capacity of human resources, carrying capacity of the local government, and economic factors of the community.

Aspects of regional resilience that if improved continuously will create a conducive situation in the life of society, nation and state to achieve national goals [17]. Regional resilience is one of the important elements in realizing national resilience. Therefore, it is necessary to create an environment that is safe and free from the risk of natural disaster impacts. The environment is safe when it is free from the risk of disaster or can reduce the impact when a natural disaster occurs. As one of the most disaster-prone countries in the world, Indonesia needs to map potential natural disasters and high-risk areas. Thus, efforts to prevent impacts and losses can be minimized and optimal disaster management. Because the

government is responsible for protecting each of its citizens as a form of human security for each individual in a country [18].

The efforts to strengthen regional resilience in several areas along the north coast of Sumbawa Island have not been well programmed and lack of government education and socialization. For example, in Labuan Kananga village, data shows that the community does not have structured and planned disaster risk prevention measures either from the government or their own initiative. The response of the local government and the community to a natural disaster is only sudden when the disaster occurs. Then there is no special location used as a temporary refuge such as temporary shelters and shelters.

The people of Calabai and Labuan Kenanga villages have never been directly affected by disasters, resulting in the absence of preventive efforts from both the community and local government. Some people do not even know the areas with earthquake potential. This ignorance is because they have not experienced a major earthquake for decades, so they forget about the faults at their feet [15]. In fact, quite a number of people live along the north coast of Sumbawa, namely Calabai village, Labuan Kenanga, and the Nangamiro Harbor area which is the main gate to Satonda island.



Picture 2. Coastal area of Nangamiro

In fact, in the Calabai village area, there have been high waves of sea water reaching the residents' houses. After the incident, the government had built a wave-retaining embankment, but the observation shows that the construction of the embankment has not covered the entire shoreline and some have been damaged. The following picture shows the community settlement on the beach. Thus, the community's ability to recover quickly from natural disasters has not yet been demonstrated because it has not yet had experience in dealing with major disasters.

Some people still regard earthquakes as a natural phenomenon that happens regularly.



Picture 3. Coastal area of Calabai

Local governments also do not prioritize natural disaster mitigation efforts. Residents admitted that they rarely collaborate and cooperate in developing rescue measures after natural disasters. BPBD, SAR, and related elements have conducted recovery during the last major disaster that occurred, the 2018 Lombok earthquake. However, there are several government programs that have been implemented, namely the construction of embankments to prevent high waves from entering residents' housing on the coast of Calabai village. Unfortunately, some of the embankments have cracked and some have been destroyed during high waves in the Flores sea.

In terms of livelihoods, although people in some of these villages live on the coast, being a fisherman is not the main livelihood. Researchers found that around 80% of these coastal residents actually work in the plantation sector such as corn, sesame, coconut. The plantation sector is more profitable than the fisheries sector, partly because of the carrying capacity of fertile land up to the hills for corn crops and the ease of selling garden products to collectors. The sea is only a connection, not a source of livelihood for the community. This condition shows that the community is less aware of the phenomena in the waters. Coconut plantation activities can be seen in the following picture:



Picture 3. coconut seed processing by moyo people

Instead of taking advantage of Satonda's tourism potential, Calabai waters are more often used as a means of transportation between islands, especially from Moyo and Medang islands to bring garden products such as corn, coconut, sesame seeds, cashews, and others. This condition shows that there is no strong attachment between coastal communities and the waters, both in terms of resource exploration and potential disasters that can arise. Indeed, coastal communities understand the natural conditions that indicate the potential for disasters such as earthquakes and tsunamis.

4. CONCLUSION

Based on the results of data analysis and processing, it can be stated that the resilience of the northern coastal communities of Sumbawa Island is classified at Level 2, which is less resilient. The lack of disaster mitigation efforts shows the unpreparedness of coastal communities in facing potential natural disasters. Unpreparedness includes the lack of government attention to educate, provide earthquake-resistant infrastructure and socialize to the community.

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Furthermore, there are several recommendations in order to strengthen the resilience of coastal communities so as to improve natural disaster mitigation efforts. Stakeholders at the Dompu and Sumbawa district levels should implement programs that focus on mitigating natural disasters on the north coast of Sumbawa Island. These mitigation efforts consist of four main aspects: preparedness, awareness and disaster management planning. Disaster preparedness is done by mapping resources, building earthquake-resistant infrastructure, and building settlements away from tsunami red zones. Then for the community, awareness efforts are needed so that people are mentally prepared for potential disasters that can occur at any time. The community is asked not to be negligent even though a major disaster has never occurred in the area.

Then conduct regular and continuous socialization and simulations to coastal communities in pre, during and post natural disaster conditions. In addition, local governments need to prepare supporting infrastructure such as the provision of earthquake detectors, tsunami early warnings, provision of temporary and permanent evacuation routes and locations. Local governments together with the community and the private sector need to immediately prepare disaster management schemes that are measurable and targeted so that mitigation efforts can actually be implemented so that the community is protected from potential earthquakes and tsunamis. In addition, it is an obligation for the government to protect its citizens in accordance with the mandate of the constitution.

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