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# Community-Based disaster mitigation and its challenge: A case study in Pangandaran coastal area, Indonesia

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**Abstract:** This paper aims to shed light on community-based disaster mitigation and the challenges encountered by using the Pangandaran coast as a case study, one of Indonesia's disaster-prone areas. Observations, in-depth interviews, and documentation studies were used to collect data. The findings of this study indicate that community-based disaster mitigation is well realized, as evidenced by community early preparedness forums collaborating with the government to provide socialization and education to the community. However, disaster preparedness still faces challenges, including; since some of the mitigation objects are tourists, mitigation efforts need to be carried out sustainably while not following the budget they have; mitigation support devices and facilities such as damaged or missing signs for evacuation routes, temporary shelters, assembly point locations, and Early Warning System (EWS) devices whose number is still not optimal; lack of participation of hotels or restaurants in disaster mitigation, especially in engaging in preventive actions to minimize disaster risk. This situation is a challenge in itself for disaster mitigation management, moreover, Pangandaran Village must maintain its status as a "Tsunami Ready" village.

**Keywords:** community-based disaster mitigation; forum kesiapsiagaan dini masyarakat (FKDM, community-based forum for early preparedness); disaster preparedness; sustainable mitigation

## 1. Introduction

Pangandaran became widely popular after an earthquake with 7.7 on the Richter scale was accompanied by a tsunami on July 17, 2006, killing over 600 people and causing many other losses. According to one study, this disaster occurred because the Pangandaran region was shifting to the north on the Indo-Australian plate by 6–7 cm per year (Pancasilawan et al., 2020), during the time of the Eurasian Plate. Based on the study, several areas in Pangandaran Regency have a high risk of natural disasters, such as villages in West Pangandaran and East Pangandaran have a high risk of earthquakes and tsunamis. This information is supported by IRBI (Indeks Resiko Bencana Indonesia, Indonesia Disaster Risk Index) data, which shows that Pangandaran is ranked 17th in Indonesia and 6th in West Java as a disaster-prone area (Pancasilawan et al., 2020).

Since then, the people of Pangandaran have become more aware of the dangers they face, knowing that a disaster could strike at any time (Hadian et al., 2016). The local government is concerned about this condition and is working to improve disaster preparedness by organizing communication and mitigation involving various community elements. Because, as emphasized by Nakamura et al. (2017), promotion of early evacuation, education about disaster prevention, and the establishment of a

system whereby residents can evacuate on their own are important to minimize disaster risk.

Community active participation in disaster mitigation is a significant element because local communities can respond more quickly to emergencies. As stated in the study of (Hosseini et al., 2014) an emergency response cannot be implemented without mobilizing local people. They also highlighted the importance of community-based activities in reducing disaster risk and evaluated the possibility of involving the community in risk-reduction activities. With the condition that is in the area vulnerable to disasters, several efforts have been made in the district of Pangandaran in disaster mitigation. Some of them are done by doing infrastructure development, and there are also doing it by communicating or mentoring to raise awareness and preparedness in dealing with disasters. Research shows that activities that do not involve enough communication among residents are difficult to implement and are considered unrealistic (Hosseini et al., 2014).

Furthermore, intense communication and information sharing on disasters with residents can serve to establish a community-based voluntary evacuation system and disaster-prevention network (Hosseini et al., 2014). Communication actions carried out as part of disaster mitigation efforts do not only provide relevant materials, such as disaster maps or plans, but the community found novel ways to improve their capabilities for reducing disaster risk and properly responding to disasters as a fundamental requirement in building disaster literacy in community level, but also efforts to involve civil society and volunteers from local communities have a very significant position.

Nearly a decade has passed, Pangandaran has not only built physical infrastructure but also community preparedness, especially for those living on the Pangandaran coastline, which in general has shown significant changes (Hadian et al., 2016). They have a higher awareness of the importance of disaster mitigation so they have the required preparedness. One of them is evidenced by UNESCO's recognition of Pangandaran Village as a Tsunami Ready Village in December 2022.

This acknowledgment is not only related to how the area's recovery efforts, but also the various efforts made jointly by the local government, volunteers from NGOs, and the surrounding community in rebuilding Pangandaran as an area that has disaster preparedness. These various elements work together to rise from social and economic downturns with several assistance from the central government, regional governments, and the private sector in disaster mitigation efforts both structurally and non-structurally.

Structurally, mitigation is carried out by providing various standard disaster mitigation facilities such as standardizing safe and informative evacuation routes, building refuge shelters, building technological devices that function as Early Warning Systems (EWS) connected to the command center at the village government office and connected with the Badan Penanggulangan Bencana Daerah (BPBD, Regional Disaster Management Agency) of Pangandaran and several community elements and other facilities. Meanwhile, non-structural mitigation is carried out by providing socialization, education, and disaster simulations to all levels of society.

Nonetheless, this synergistic effort between the government and the community is still facing challenges. As one of the popular tourist destinations in West Java,

Pangandaran has an increasing number of tourist visits, especially domestic tourists, from year to year. As in tourist destinations, tourists come and go one after another so disaster mitigation is needed that is sustainable. This sustainability challenge is also related to business actors who do not all come from Pangandaran which sometimes it is difficult to work together to maintain disaster preparedness. In fact, the increasing number of tourists in Pangandaran has an impact on increasing the tsunami disaster risk (Nijman, 2021). As a result, this paper attempts to reveal the extent to which community-based disaster mitigation measures have been implemented and the various challenges that the government and community have faced in maintaining Pangandaran's status as a "Tsunami Ready" village. This study is important to explore the latest facts about community preparedness for disasters in the Pangandaran region.

## 2. Literature review

Disaster mitigation has been extensively studied as the most basic element in creating public awareness in disaster-prone areas. However, during a disaster emergency, the public's acceptance of disaster information is commonly related to the level of public trust in the authenticity of the information. In other words, in a disaster emergency, people will not pay too much attention to and follow up on the information conveyed so this will prevent the information from becoming usable knowledge (Fisher, 2013).

Thus, trust is a vital element in disaster mitigation and communication so that information can be acted upon quickly (Murayama et al., 2013; Reinhardt, 2015). Even one study reveals that trust can improve the quality of the communication process and the overall efficiency of information retrieval (Johnson, 2007). This fact implies the importance of a particular approach in disaster mitigation so that information can be absorbed and can become a reference for the public in disaster-prone areas.

One approach to building public trust is the culture-embedded disaster communication approach or the involvement of cultural elements in the disaster communication process (Gultom, 2016). The inclusion of cultural values has an important role in encouraging trust in information which in turn can increase the effectiveness of disaster information at the individual level. This proves that strong and weak relationships between individuals within the community have different roles in disaster communication. Strong ties will be more effective in facilitating the diffusion of information and encouraging trust and community participation.

Several studies on the importance of trust in disaster communication examine risk perception and disaster response behavior, both of which are closely related to cultural beliefs (Donovan, 2010; Lavigne et al., 2008). Some of these studies, however, acknowledge that cultural beliefs are frequently at odds with the scientific approach used by authorities (Donovan et al., 2012). For example, in some cases, people are more likely to practice cultural knowledge (Dougall et al., 2008). In contrast, authorities frequently take a scientific and institutional approach, focusing on hazard-related factors while ignoring society's cultural rationality (Sandman, 1993). Therefore, to gain public trust, the authorities must use a homophile approach or understand the cultural values of the community.

Several other studies support this idea, revealing that cultural values must be involved to encourage people's trust in disaster situations (Fronz, 2012; Romo-Murphy, 2011). Even though these studies show a positive relationship between culture and disaster, socio-cultural factors have received little attention in most crisis and cultural communication theories (Donovan, 2010; Fronz, 2012). Indeed, culture and community trust are important factors that foster trust and active community participation in disaster mitigation.

A lack of attention to community cultural factors manifests through the involvement of local communities in the process of risk reduction and disaster communication in countries with a top-down government structure (Allen, 2006; Buckland and Rahman, 1999). In other words, a top-down governance system has implications for minimal community participation in disaster mitigation. Disaster management and mitigation must be managed equally at various levels of government and strategic sectors to be more effective (Mushkatel and Weschler, 1985). At this point, disaster communication is a strategic step that seeks to increase local capacity and coordinate with the central level, which operates at the highest level.

However, more important than the goal of disaster mitigation is the fact that community behavior is not limited to individual efforts in disaster response but also community-based activities that play an important role in disaster prevention (Kapucu, 2012). This was supported by a study conducted by Nakamura et al. (2017) which discussed community-based disaster prevention activities and meetings held throughout Japan and found them to be effective. This effort involves not only residents but also local university students who have some knowledge about disasters, and by increasing awareness of the objectives and system of implementation of disaster prevention plans, smooth communication was to ensure their capacity was improved.

Disaster management, in other words, must involve both local managers and community planners to create opportunities for local community participation which Drake (1991) defines as local communities' ability to influence certain development outcomes that affect them. As a result, this effort is critical for schools, hospitals, and other critical facilities. Managers and community planners should be directly involved in discussions and decision-making as communities retrofit existing infrastructure. This is significant because increased community participation and local leaders are associated with more satisfying outcomes in disaster-risk reduction activities (Hosseini et al., 2014).

This is demonstrated in several cases. In Nepal, community-based organizations are actively involved in the process of empowering citizens and encouraging public participation in disaster response. They estimate disaster risk in the community, plan for risk reduction, raise public awareness, prepare local communities for potential earthquakes, and lay the groundwork for emergency response at the community level (Hosseini et al., 2014). In Indonesia, after the Aceh and Sumatra tsunamis in 2004, some foundations implemented relief and reconstruction with the assistance of local religious community-based organizations and NGOs (Luna, 2001; Pandya, 2006). Using local communities' capacities, they work together in providing protection and safety for survivors, creating rapid response units, and developing emergency aid for rebuilding damaged areas (Pandya, 2006).

As previously stated, community-based disaster mitigation efforts are a manifestation of community participation as a process to give the community more authority to jointly solve problems (Nakamura et al., 2017). The level of community participation in these activities determines the division of authority. Furthermore, community participation is to find better solutions to problems, with the community's role being to contribute to the implementation of a more effective, efficient, and sustainable system. Because the community may not be motivated to prepare if they do not perceive natural hazards as critical issues in their community, disaster communication becomes the most important factor in developing a disaster-resilient community, namely a community that has its own resilience in anticipating and minimizing destructive forces through adaptation (Hadian et al., 2016).

Specifically, many studies on communication and disaster mitigation have been conducted in the Pangandaran area, both as government efforts and as community-based mitigation efforts. Pancasilawan et al. (2020) investigated disaster mitigation by the Pangandaran government using both structural and non-structural approaches. A structural approach focuses on physical development, such as the construction of temporary evacuation sites or the establishment of an EWS. Meanwhile, non-structural mitigation is carried out by emphasizing disaster education and training in schools and communities to increase their capacity and role when disasters strike (Pancasilawan et al., 2020). Furthermore, disaster mitigation and communication are carried out by increasing disaster mitigation literacy with the local wisdom of indigenous people approach as one of the appropriate communication strategies to build disaster mitigation literacy (Damayani et al., 2022).

Another study found that the EWS and community-based disaster risk reduction significantly contributed to disaster preparedness in Pangandaran (Hadian et al., 2016). Even in a more detailed study, Wargadalam (2021) notes that one of the efforts to achieve disaster preparedness can be accomplished using computer-based visual simulations. He revealed that computer simulations of the effectiveness of evacuation routes in disaster situations have been shown to increase people's knowledge of rescue decisions.

In terms of community participation, a study shows that the community and volunteers from various communities who carry out socialization and disaster simulation also play a role in strengthening community resilience in the Pangandaran community (Bakti et al., 2023). This study emphasizes the effect of communication factors, which include communicators and messages, on the level of community resilience in the face of disasters, demonstrating that communicator and message factors have a significant relationship with the level of community resilience in the face of disasters at Pangandaran.

Although the various studies above have provided varying analyses of the context of disaster mitigation in Pangandaran, some of them even provide an overview of the reality of disaster preparedness among the community as a result of disaster communication actions. However, one of the significances of this study is that it is more focused on exploratory efforts related to community-based disaster mitigation and communication, as well as the various challenges faced to provide an overview of current conditions to support efforts to create sustainable disaster preparedness.

## 3. Methods

This study employs the case study method to investigate aspects of the social environment, including humans (Alston and Bowles, 2019; Yin, 1994). This method is assumed to be effective because it can be used to discover phenomena and motives associated with various contexts of community-based disaster mitigation and challenges. This is a cross-sectional study conducted from May to June 2023 in Pangandaran Village, which is considered successful in developing community-based disaster mitigation strategies.

Data were gathered through observation, in-depth interviews, and documentation studies. Observations were conducted throughout May and June 2023 simultaneously by observing various activities carried out by the Badan Penanggulangan Bencana Daerah (BPBD, Regional Disaster Management Agency) mitigation implementation, the activities of the Forum Kesiapsiagaan Dini Masyarakat (FKDM, Community-Based Forum for Early Preparedness) of Pangandaran, and several disaster mitigation facilities and instruments in the Pangandaran area to obtain a factual picture regarding community participation in disaster mitigation.

Meanwhile, in-depth interviews were conducted in Bahasa Indonesia with several informants who were purposefully chosen based on the following criteria; disaster mitigation managers, activists, and volunteers, as well as several members of the general public who were randomly selected based on disaster knowledge to demonstrate disaster mitigation activists and volunteers' performance. The interview excerpts presented are in Bahasa Indonesia. To ensure no ethical violations, all informants have been informed, and they have no objections to having their identities or positions displayed, though some prefer to remain anonymous. During the documentation study, any written information to support the findings of observations and interviews was collected.

## 4. Results and discussion

Pangandaran Regency is a relatively new regency since administratively, Pangandaran is the result of regional expansion from Ciamis Regency in 2012 based on the Law of the Republic of Indonesia Number 21 of 2012 (Mamuksinudin, 2012). Regionally, Pangandaran has a unique topography because it is located on the south coast of West Java and also directly adjacent to Cilacap regency of Central Java. Although situated on the beach, Pangandaran Regency has a highland structure of hills. The broad coverage of Pangandaran Regency area is approximately 1010.92 km$^2$ consisting of 10 sub-districts and 93 villages (Pancasilawan et al., 2020).

The official recognition of Pangandaran Village as a "Tsunami Ready" Village by UNESCO in December 2022 indicates a new chapter in disaster management in Indonesia. This recognition is a "gift" for all elements of society who have contributed to the project of building a disaster-resilient community. The BPBD of Pangandaran recognizes this as the authority coordinating various elements and the community in disaster mitigation.

### 4.1. 'FKDM' and early preparedness of the community

In several studies, Pangandaran Regency has a relatively high potential for disasters, especially in the West and East Pangandaran areas which have a high risk of earthquakes and tsunamis (Faiqoh et al., 2013; Nijman, 2021). With the region that is vulnerable to disasters, several efforts have been made in the district of Pangandaran in disaster mitigation. Some of them are done by doing infrastructure development, and also by implementing or mentoring so people have adequate disaster preparedness as explained by the head of the BPBD of Pangandaran as follows:

> "For mitigation purposes, we continuously provide education and simulations to all members of the community, especially along the coast, so when a disaster occurs, the community understands what to do. The schools should also have this capacity… I even want outreach and simulation to be prioritized for the community and schools because this must be understood from the earlier ages…" (Interview, June 2023).

Especially for non-structural mitigation, BPBD of Pangandaran has a main program in providing education and simulations to the community, especially those in disaster-prone areas. Ideally, this effort is expected to foster community preparedness to reduce disaster risks. Specifically, the BPBD of Pangandaran illustrates:

> "When an earthquake occurs, for example, the first thing we take cover is anything close to us, we can take cover under a table when it subsides we go to a gathering. Actually, we can also use various media to carry out socialization and simulation. For children, for example, using comic books or for the general public socializing through books..." (Interview, June 2023).

BPBD of Pangandaran acknowledges that disaster mitigation is an effort that must involve all parties. Therefore, they collaborate with several agencies such as the Health Service Agency, Social Service Agency, Regional Secretariat for Social Affairs, Education Agency, Public Works Agency, and the Civil Service Police Unit (Satpol PP), all of which work in coordination with BPBD of Pangandaran.

However, as previously mentioned, efforts to build a disaster-resilient community are also due to the role of the community, most of whom are members of the FKDM. This forum itself is initiated BPBD of Pangandaran Regency to stimulate community participation in disaster risk reduction. Formally, this forum has a working area around the village level which works on the decree of each village head and coordinates with BPBD.

In other words, disaster mitigation efforts are carried out with a partnership approach that involves the community down to the lowest level in the government structure. The FKDM itself is actually a practical manifestation of a more strategic program, namely 'Desa Siaga Bencana' (disaster-ready village) which also requires community participation as the frontline in dealing with disasters. This was expressed by Iman, a Pangandaran Village official as follows:

> "…We also form disaster preparedness villages as partners and ensure that they are well-trained, which will be the frontline when facing disasters. This activity can use Dana Desa (Funds from the government –authors) following the regulation that Dana Desa can be used for anything, including for the needs of disaster-affected communities" (Interview, June 2023).

Through FKDM, the government ensures that some individuals have qualified skills in building disaster preparedness at the village level. Formally, the number of volunteers of each FKDM is on average 40 people who come from representatives from each RT and community leaders as well as volunteers from various mass organizations and NGOs. To date, 20 FKDMs have been formed from 93 villages throughout Pangandaran Regency and the majority of these have a number of disaster mitigation agendas for the community. As stated by the Pangandaran Regency BPBD authority, this number is still temporary and will continue to grow:

> "Until now, only 20 FKDMs have been formed because of the scale of priorities and budget constraints. Nonetheless, we make optimal use of the number of FKDMs that have been formed to provide assistance and increase community capacity regarding preparedness…" (Interview, June 2023).

Based on observations, the majority of FKDM actively collaborate and coordinate with related parties. Collaboration with local communities is aimed at solving problems, especially in terms of the EWS and disaster preparedness activities, such as providing socialization and communication about safe and easy evacuation routes. FKDM's active participation is not only for the public around disaster-prone areas but also at all levels of community. Even in several areas, FKDM and BPBD also initiated the formation of "Sekolah Siaga Bencana" (Disaster Preparedness Schools), namely school-based disaster preparedness cadres at various levels. This was stated by the Pangandaran FKDM Coordinator, Sutan Abdul Rosid as follows:

> "Especially for non-structural disaster mitigation, we run by conducting socializations and simulations in various levels of society, even in schools involving teachers and students. For socialization in schools, apart from increasing their capacity, we also recommend schools to have standard equipment for disaster emergencies such as; evacuation routes, assembly points, stretchers, and things to do in an emergency …" (Interview, May 2023).

This is in line with the expression of the BPBD officials:

> "To minimize disaster risk, every school must have a safe evacuation route, and there should also be a disaster preparedness school... There also needs to be a local content curriculum related to disaster preparedness so that the school community can have adequate capacity..." (Interview, June 2023).

All of the information above provides a practical overview of the various disaster mitigation activities that have been carried out involving community participation and have proven successful by obtaining the status of a "Tsunami Ready" Village at the end of 2022. Based on observations and the narratives of several residents, they have shown their appreciation for FDKM as a government partner in creating community preparedness for disasters. This is illustrated as follows:

> "I'm not too worried anymore… I have participated in counseling (socialization-authors) conducted by volunteers several times and I have memorized the nearest shelters and safe evacuation routes. I think all of us here also understand it…" (Interview, May 2023).

Meanwhile, another resident expressed the following statement:

"In the last (disaster) event, my family and I immediately fled to the temporary shelter at the Grand Mosque because previously we had received instructions in socialization given by officers. There, we were asked to wait for information from the officers about the latest developments…" (Interview, May 2023).

Based on the statements of the two informants above, it appears that in general, the people in the Pangandaran Village area can reduce disaster risk by memorizing safe evacuation routes and knowing the locations of temporary shelters when disaster occurs. This proves that disaster mitigation efforts through outreach and coaching have increased their capacity in disaster risk reduction. Meanwhile, other residents gave their views on the role of Sutan Abdul Rosid, or they called as Pak Ocid, as an FKDM activist. They have confidence that the guidance provided by Pak Ocid and his team can be a guide because they are seen as having an understanding of the area and issues related to disaster potential and risk. This is as stated as follows:

"I think that all people around here know Pak Ocid (Sutan Abdul Rosid –authors). He has several times given directions to the public about what to do when disaster occurs… Several times, I even saw him giving directions to tourists regarding evacuation routes." (Interview, May 2023).

This informant illustrates the reputation of FKDM and also Pak Ocid as a facilitator for disaster mitigation activities, especially in the Pangandaran Village area. As an individual, Pak Ocid himself is a figure who concern about environmental issues for a long time. Long before being active in FKDM, he was known as a facilitator of community service. In fact, he was invited several times as a speaker in disaster socialization at the local, regional, and national levels.

Thus, this strengthens the view that disaster communication and mitigation are indeed influenced by individual factors. The high level of public trust in individuals in this regard is due to the figure of Pak Ocid who is known for his consistency in capacity building of the community for a long time. Apart from that, their trust also seems because Pak Ocid is a local resident of Pangandaran.

## 4.2. Disaster preparedness and challenges of sustainable mitigation

Effective disaster mitigation requires sustainability to ensure that people's knowledge and preparedness for disasters. Moreover, since disaster mitigation efforts require continuous education and socialization, the partnership between the government and the community must also be carried out. Based on observations, in general, there are 3 (three) aspects which potentially become challenges in maintaining this sustainability, namely; the community as the target of mitigation, the tools and media supporting mitigation, and the external support such as business actors in the tourism environment.

Firstly, the community is mitigation targets. The parties who are the object of disaster mitigation are all levels of society in disaster-prone areas. For local communities, basically, preparedness has been well developed. This does not only contribute to the mitigation programs carried out by the government and volunteers but is also based on their experiences of being affected by previous disaster events. However, people in the tourism area are not only permanent local residents, but also

residents from outside of the area, both as tourists and as business actors around Pangandaran Beach.

The FKDM volunteers recognize this situation as a challenge which forces them to continuously conduct socialization, education, and simulation, especially for residents which come from the outside of Pangandaran. This is as stated by Sutan Abdul Rosid as follows,

> "It seems that the people here have already know mitigation material very well, or maybe they even get bored because the material is always the same... but people in tourism area are always changing. Not all retail business actors around the coast come from here, but some come from other villages or outside the region… even though they also have an interest in information related to disaster risk reduction." (Interview, May 2023).

In fact, according to Pak Ocid and other volunteers, some residents from other villages did not know more about earthquakes and tsunamis and what to do when it occurs. To anticipate this, mitigation is also carried out by involving retail actors around the beach to participate in tsunami simulation activities. Even FKDM volunteers recommend this for big events such as the Pekan Olahraga Provinsi 2022 which held in Pangandaran.

> "At the event of Pekan Olahraga Provinsi, we asked the committee to conduct an audit and inform us the scenario for the tsunami earthquake disaster simulation by involving all elements, not only to local communities but also to retail business actors in Pangandaran... also, we always remind the standards socialization and education in various ways…" (Interview, May 2023).

The statement above suggests that community capacity as a mitigation object remains a priority that is being pursued by FKDM and volunteers in coordination with BPBD of Pangandaran. At this point, the volunteers and FKDM are facing another challenge, which is related to limited funding. This was emphasized by Iman, an officer at the Pangandaran Village Office:

> "It's a bit of a dilemma... on the one hand we are concerned to build community-based preparedness, but on the other hand, we are dealing with other problems related to funding from the government. Because to put people together from various elements need the adequate financial support…" (Interview, May 2023).

In other words, even though the FKDM and other volunteers have a standard agenda for mitigation, they sometimes encounter obstacles due to limited funds. Therefore, some of the disaster mitigation activities organized by FKDM are carried out independently by utilizing existing resources. However, in general, it can be seen that basically the local community of Pangandaran is seen as already have adequate capacity related to disaster mitigation, but not so with communities coming from the outside of Pangandaran, both as businessman and as tourists so this is another challenge since the socialization actually raises the other challenges.

Second, the aspect of facilities and media. The disaster mitigation agenda always leads to two categories, namely structural mitigation and non-structural mitigation. Some of the things that have been discussed previously refer to non-structural mitigation because it is an effort to build knowledge and strengthen disaster preparedness behavior. However, since structural mitigation is related to the

construction of supporting physical facilities in disaster risk reduction, this section will reveal various challenges that have a structural dimension, including information media that can be accessed by the community.

Based on observations, Pangandaran Village has had a command center that functions as a disaster information control center which is adequate and functioned properly. In addition, other physical facilities include evacuation route signs, temporary shelters, assembly point locations, and three units of EWS devices (see **Figure 1**). However, based on observations, some of these facilities began to experience damage, disappear or change functions, especially evacuation routes. In addition to this damage, the BPBD also revealed that the number of evacuation routes was still minimal, as explained below:

> "The evacuation routes and gathering points are still our homework because along the 91 kilometers coast, it is not complete yet... even though the lack of evacuation routes will affect the understanding of residents or tourists when a tsunami occurs. To get around this, we are trying our best by coordinating with several related parties, especially with villages on the seashore…" (Interview, June 2023).



**Figure 1.** Evacuation routes and temporary shelter building (photo by authors).

Another problem related to disaster mitigation facilities is the lack of EWS unit. Even though they already have 3 EWS units installed at three points, this number is still not optimal when compared to the potential and risk of disasters. The EWS function is highly significant in providing warnings to the public in the event of a disaster. This was also conveyed by the Head of BPBD in the following statement:

> "We admit that the number of EWS we currently have is still not optimal considering the risks are quite large. So far, we only have three units installed at three points, namely on Bojong Salawe Beach, Pangandaran Beach, and Cikidang. However, we are still working on this because the cost of installing this EWS device is relatively expensive…" (Interview, June 2023).

Another challenge is also related to disaster information media that can be accessed by the public. Even though evacuation route signs can be classified as information media, information of a public still encounters obstacles whereas in a disaster situation, the source of information must be clear, centralized, and verified to avoid misunderstandings which lead to panic. Based on observations, even though the BPBD has an official Instagram account, the information presented is not specific to disaster mitigation.

So far, the media used by the government and volunteers still rely on existing institutions, one of which is Balawista which coordinates with BPBD, the Tourism Office, and the Badan Meteorologi, Klimatologi dan Geofisika (BMKG, Meteorology, Climatology and Geophysics Agency). In fact, today's society cannot be separated from media technology and therefore the government and volunteers need to optimize the function of social media as a source of information to optimize disaster information services for the wider community.

Third, external support. This aspect refers to business actors which mostly retail businessman and hotel owners in the Pangandaran Beach area. In a study, it was revealed that the increase in tourists (domestic) in Pangandaran had implications for increasing the risk of a tsunami disaster so the involvement of business actors, especially hotel owners, was needed to provide disaster risk information and safe evacuation routes when they arrived (Nijman, 2021).

However, this does not mean that the hotel does not show their participation. In an emergency situation, several representative hotels have contributed by their willingness to be functioned as temporary evacuation sites as well as grand mosque, a natural reserve, and a shelter located in Pasar Wisata area, north of the coast of Pangandaran. However, based on the narrative of Iman, a Pangandaran Village official, the hotel's contribution still does not reflect an awareness of the importance of disaster mitigation:

> "Disaster mitigation is not only how to act in a disaster situation, but also how to act in reducing disaster risk, one of which is by providing adequate information about disaster risk and all matters related to it. Well, some hotels have indeed shown their participation by providing temporary shelter facilities when a disaster occurs, but it would be better if they were also actively involved in preventive actions to minimize the risk…" (Interview, May 2023).

The above statement illustrates that there is a bit of disappointment over the lack of participation of hotels in disaster mitigation efforts. Even though so far, the BPBD and FKDM volunteers have urged them to fully participate. However, based on observations, several hotels and restaurants already have disaster emergency equipment such as easy-to-understand evacuation routes and adequate assembly points.

Following up on this, BPBD and FKDM volunteers suggested that all hotels on the coast should not only have completed with disaster emergency equipment but also offer disaster mitigation activities through general managers of the hotels who are expected to provide disaster management training to their employees. Even though the training could be carried out, they still did not show significant support because they only sent lower-level employees. This is as expressed by Pak Ocid below:

> "I always emphasize that disasters are not only the responsibility of the government and society, but also the business including hotels, especially in disaster-prone tourism areas. I was once annoyed because the representative participants sent by each hotel were generally lower-level employees and did not have any authority to make decisions… In fact, if hotels have the capacity in disaster management, they will also have certain added value… (Interview, May 2023).

According to the statement above, volunteers show the impression that hotel owners did not have proper contribution to disaster mitigation efforts in the Pangandaran area because they only sent lower-level employees who did not have rights in decision-making. This suggests that the point meant by BPBD and FKDM volunteers is technical skills related to the preparedness of hotel crews in carrying out their functions for disaster emergency situations. This is as illustrated in the following expression:

"I was once speech for disaster mitigation event with the BPBD of West Java Province. In this activity, I emphasized that hotels and restaurants have Standard Operating Procedures (SOP) when a disaster occurs. For example, how do each employee, such as room boy, receptionist, cleaning service, chef, and so on, carry out their functions in an emergency situation. We call it the emergency command for disaster management… Because in a disaster emergency, even the receptionist cannot receive emergency calls from hotel guests…" (Interview, May 2023).

The emergency command, as the volunteers call it, is a strategic effort in disaster risk reduction actions that can be played by hotel employees. This is a constructive suggestion for hotel owners in disaster-prone tourist areas. Until now, FKDM volunteers are still fighting for this idea with related parties such as the Tourism Office, Hotel Owners Association, and BPBD so that it can be accepted by hotel owners so that sustainable mitigation can be realized.

Overall, it can be said that community-based disaster mitigation has gone well and even received appreciation from UNESCO. The presence of FKDM as a manifestation of Pangandaran community participation has contributed to the entire disaster mitigation process, especially for non-structural mitigation where they communicate through socialization, education, and simulations for disaster prevention. The existence of FKDM is also a form of bottom-up policy, namely opening up community participation to build community disaster awareness and preparedness. However, to maintain sustainability, support and participation from various parties are still needed, including business actors and hotel owners who carry out commercial activities in areas with disaster risk.

## 5. Conclusion

With a relatively high potential for natural disasters, disaster mitigation efforts in the Pangandaran area are significant. In structural mitigation, the Government, through the BPBD in collaboration with various parties, facilitates several tools and infrastructure needed for disaster risk reduction. While, non-structural mitigation is carried out by communicating through outreach, education, and disaster management simulations to all levels of society, including schools. Apart from that, the government also established Forum Kesiapsiagaan Dini Masyarakat (FKDM, Community-Based Forum for Early Preparedness) at the village level so that it received appreciation from UNESCO.

However, several challenges were still encountered in efforts to maintain the sustainability of this mitigation. First, although basically the preparedness of local communities has been formed, migrant communities must still receive education and

socialization. Second, challenges related to aspects of equipment and supporting media; for example, even though they already have signs for evacuation routes, temporary shelters, assembly point locations, and EWS devices, they are still not optimal and do not maximize the media as a source of disaster information. Third, the lack of participation of hotel owners in disaster mitigation efforts, especially in engaging in preventive actions to minimize disaster risk.

However, we realize that this study still has some limitations regarding focus and methodology. Because this case study focuses on community-based disaster mitigation in Pangandaran, especially around tourism sites, it may contain biases related to the characteristics of people around tourism destinations. Therefore, the next study can be carried out in a more general context. In addition, future research may also use a different approach so that it may provide different results.

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