Enhancing Disaster Resilience: Evaluating the Implementation of an Early Warning System through Table Top Exercises

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Abstract

This research investigates the periodic implementation of an Early Warning System (EWS) using the Table Top Exercise (TTX) method to assess its effectiveness in enhancing community preparedness for disasters. Specifically, it analyzes the utilization of the Early Warning System as a disaster communication medium through the Table Top Exercise method and identifies challenges faced within the Disaster Risk Reduction Forum in Gung Pinto Village, Kec. Namantaran District, Karo. The study focuses on the People-Centered Early Warning System and the incorporation of Local Wisdom in the Early Warning System. The research employs the Knowledge Construction Theory as its theoretical framework. Data is gathered through interviews, observations, and document analysis, with qualitative analysis methods applied. The study concludes that the implementation of an Early Warning System (EWS) can significantly mitigate risks and safeguard communities against disaster impacts. Additionally, it highlights challenges such as limited information accessibility, resource constraints, and time limitations in the process.

Keywords: Early Warning System; Disaster Communication; Table Top Exercise.


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INTRODUCTION

Efforts to reduce disaster risk (Disaster Risk Reduction) are very important to protect the community and minimize the negative impacts they cause. One of the key aspects in reducing disaster risk is the early warning system, which functions as an effective communication medium for disseminating information about disaster threats to the community (Paripurno, 2022). According to the Indonesian Disaster Risk Index (IRBI), Indonesia is among the countries with the highest seismicity rate in the world, more than ten times that of the United States. The Indonesian Disaster Risk Index (IRBI) issued by the National Disaster Management Agency shows that North Sumatra Province is at a moderate disaster-prone level. IRBI also explained that Karo Regency, which is dominated by disasters such as the threat of earthquakes, volcanoes, and landslides, also has a moderate level of disaster risk. (BNPB, 2022).

Mount Sinabung, located in North Sumatra province, is one of the active volcanoes in North Sumatra. Mount Sinabung's volcanic activity was unknown for almost 400 years. After several decades of inactivity, the major eruption on August 27, 2010, on Mount Sinabung has experienced a series of serious and repeated eruptions. These eruptions have caused significant material losses, loss of life, and negative impacts on local communities. The Center for Volcanology and Geological Disaster Mitigation page, 7 September 2010, said that the eruption began with shallow earthquakes on 06 September 2010 at 21:00 WIB. According to data from BBC.Com, tens of thousands of residents took refuge at several evacuation points (BBC.Com, 2010).

Looking at historical records and data on the Mount Sinabung eruption disaster, there is an urgent need to build and implement an effective Early Warning System (EWS) in the region. An Early Warning System (EWS) is a series of steps used to detect disaster threats and provide warnings to affected communities. To increase the effectiveness of the Early Warning System (EWS), it is important to actively involve the public in the warning and emergency response process. This approach, which involves the active participation of local communities, aims to utilize their traditional knowledge in detecting and responding to disaster threats (Lestari & Rinasti, 2020).

The people of Gung Pinto Village have been familiar with the system of recognizing early warning patterns based on local wisdom that has been passed down through generations. These warnings will usually be shown from natural signs, ranging from unusual animal behavior to changes in natural conditions themselves at certain times (Wagiran, 2013).

By looking at the results of previous research, although Table Top Exercise (TTX) is not suitable for the post-disaster stage, it is important to adopt a holistic approach in implementing a community-based Early Warning System (EWS) and local wisdom (Suleman et al., 2022). The pre-disaster and emergency stages provide opportunities for stakeholders to train and prepare to respond to disasters, while the post-disaster stage emphasizes recovery, capacity building, and rebuilding communities that are resilient to future disasters (Lestari et al., 2019).

By adopting a community-based approach and local wisdom, and combining it with the Table Top Exercise (TTX) method, it is hoped that the implementation of the Early Warning System (EWS) around Mount Sinabung can be improved. Through increased public awareness, better information accessibility, adequate resource allocation, and more active community participation, early warning systems can help reduce losses and protect the lives of people living in disaster-prone areas (Husna et al., 2020).

Disaster communication is a form of management of the process of producing messages or information about disasters, disseminating messages, and receiving messages from the pre-disaster stage, during a disaster and post-disaster (Lestari, 2018).

People-centered Early Warning system is an early warning system that focuses on the needs and active participation of the community in reducing disaster risks. The People-Centred Early Warning System aims to increase community capacity in taking appropriate action when facing disaster threats and integrate local experience and knowledge in the early warning process (Guru & Santha, 2015). This system includes aspects of active community involvement in
monitoring the surrounding environment, sharing information, and making decisions regarding actions that must be taken in emergencies. The People-Centred Early Warning System also pays attention to issues of gender equality, sustainability, and inclusiveness in the early warning process, so that all levels of society can be actively and equally involved (Lestari, 2018).

Local wisdom with the definition, "Local wisdom is the knowledge that local people have gained through trial-and-error experience combined with an understanding of the culture and environment of the area." The function of local wisdom, which is created and connected to the situation on a global scale, is dynamic. The definition of local wisdom is implied by the following meanings: 1) Local wisdom is a long-term experience that functions as a guide to behavior; 2) It is impossible to separate the owner’s environment from local wisdom; 3) Local wisdom is always developing, adaptive and open to change. Local wisdom is always linked to human life and the environment, as depicted in this idea. Local wisdom appears as a guardian or filter of the global climate that affects human life (W. Darmawan et al., 2022).

Table Top Exercise (TTX) Disaster communication can be explained by managing the process of producing messages or information about disasters, disseminating messages and messages from the pre-disaster; during disaster, and post-disaster stages, disaster communication is a comprehensive effort to prevent and reduce disaster risks (Addiarto & Wahyusari, 2019). Disaster communication model using the Table Top Exercise (TTX) method, communication and coordination between stakeholders must be evaluated regularly to ensure readiness to respond to disasters. The Table Top Exercise (TTX) method is a disaster communication training model. Communication about disasters is an effort to prevent and reduce disaster risks. A comprehensive approach is taken when creating messages or information about disasters, disseminating and receiving messages from the pre-, during, and post-disaster stages (Lestari et al., 2019).

The Table Top Exercise (TTX) method is needed so that each party involved in disaster management fully understands the role they have (Darmawan & Kamaluddin, 2021). The future cannot be predicted, but using Table Top Exercise (TTX) simulations, the risks that arise can be estimated. Disaster communication management planning with the minimum risk can also be realized (Addiarto & Wahyusari, 2019). A fundamental component of a disaster communication strategy is the use of the Table Top Exercise (TTX), which allows messages about environmental conditions, both physical and social, to be conveyed to others by individuals (leadership) or groups (Lestari et al., 2019).

The theory of social construction of reality, which is the main idea or principle in the sociocultural tradition, is applied in the theory of knowledge construction. Humans can use this theory as a model to understand their own experiences in life. Berger and Luckman (1996) in (Tanjung et al., 2021) said, that in social construction, reality is formed socially because there are two connected realities, namely objective reality and subjective reality through three moments, namely: externalization, objectification, and internalization.

From the perspective of Berger and Luckman (1996), it becomes clear that the externalization stage is a process of self-expression through physical and mental activity. The next step is the process of objectivation, where human behavior becomes habitual and institutionalized, resulting in typification. And finally, the internalization process, where individuals try to identify themselves with certain social institutions as part of the broader context of society (Tanjung et al., 2021).

The communication model for disaster preparedness for the eruption of Mount Sinabung through table rehearsals is considered optimal. According to Lestari, this communication model needs to be improved when an eruption occurs (Lestari et al., 2019).

At each potential disaster point, it can be reached using the Global System for Mobile (GSM) communication mode, so they see this as potential for the application of Early Warning System (EWS) technology based on wireless sensor networks and Global System for Mobile (GSM) technology. Apart from early warning, it can also be used to mitigate flash flood disasters in partner villages. In general, the Early Warning System (EWS) system
scheme is implemented (Adipradana et al., 2021).

Public understanding and awareness of the importance of mitigation and preparedness for flood disasters is now starting to appear, and this is demonstrated by the readiness of existing disaster preparedness groups with various programs and activities (Suwarini & Kurniawan, 2019).

**RESEARCH METHODS**

This research uses a qualitative descriptive method by the problem and research objectives. Informants in this research were determined using a purposive sampling approach by taking key persons, namely people who had implemented a Local Wisdom-based Early Warning System (EWS), namely the Head of Gung Pinto Village, Chair of the Gung Pinto Village Disaster Risk Reduction Forum and Regional Facilitator of the Regional Disaster Management Agency North Sumatra Province. Data collection techniques in research are carried out through several techniques, including interviews, observation, and documentation studies (Sujarweni, 2014).

In this research, there are three types of data used, namely, data reduction, data presentation, and concluding (Hardani, 2020). In the data reduction process, interview data with informants has been transcribed, coded, and grouped based on relevant topics or themes. Meanwhile, data presentation processes data that has been reduced and then presented through direct quotes from interviews in tabular form to visualize the information. And in the process of concluding, data analysis is carried out to identify the findings that emerge. The findings are then linked to relevant theories and concepts, and research conclusions are explained based on the results of data analysis.

In this study, researchers used triangulation based on sources. The triangulation process was carried out in this research by combining data from three different informants, namely the Gung Pinto village head, the head of the PRB forum, and the BPBD facilitator, through interviews. After the interview, the results are compared and analyzed to match the findings and look for similarities and differences between the informants' answers. The results of source triangulation provide higher validity and reliability of the data. By obtaining different points of view, researchers can understand the implementation of the community-based Early Warning System (EWS) and local wisdom in the Gung Pinto area comprehensively (Sugiyono, 2017). The research was conducted in Gung Pinto Village, Kec. Namantarane District, Karo.

**RESULTS AND DISCUSSION**

**Implementation of the Early Warning System as a Disaster Communication Media using the Table Top exercise method**

**Table Top Exercise (TTX)** is carried out through discussion sessions involving various stakeholders related to disasters, such as government agencies, disaster management agencies, medical personnel, firefighters, and other community organizations.

By conducting simulation exercises, stakeholders can identify weaknesses and errors in procedures and response plans, so they can correct them before a real disaster occurs. Apart from that, Table Top Exercise (TTX) also allows stakeholders to coordinate, communicate, and understand their respective roles in emergencies.

The use of an Early Warning System (EWS) using the Table Top Exercise (TTX) method is very important because it can increase awareness of potential disasters in an area, reduce the impact caused by disasters, and increase the preparedness and responsiveness of the community and government to disasters. With an effective early warning system, it can be hoped that the level of damage and loss of life due to disasters can be minimized.

**A. Community-Based Early Warning System (People-Centered Early Warning System)**

1. **Pre-Disaster Stage**

At this stage, the implementation of the Early Warning System (EWS) is community-based in identifying disaster risks in their area. Disaster risk used at this stage is through consultation, dialogue, and participatory data collection activities, the community provides information about possible disaster threats, regional vulnerability, and existing resource capacity. At this stage, the Early Warning System (EWS) is used as a medium for conveying information in the form of education to increase understanding in the
form of training to the public about the early signs of a disaster, how to deal with emergencies, the use of safety equipment, and precautions that need to be taken.

2. Emergency Stage

At this stage, the Early Warning System (EWS) plays an important role in providing early warning to the public when a disaster threat approaches or occurs. At the emergency stage, equipment is used to convey messages that are interpreted and recognized collectively in providing information about the disaster event being faced. The tool used as a communications medium chosen and mutually agreed upon in conveying disaster messages is Toa (loudspeaker). The PRB Forum will convey disaster messages through Toa so that the public can immediately get information about upcoming dangers. In addition, the Early Warning System (EWS) helps in providing clear evacuation guidance and safe routes to people in the danger zone.

An Early Warning System (EWS) is also used to disseminate emergency information to the community, including information regarding the development of the disaster, instructions from the authorities, location of evacuation sites, access to resources, and important services that need to be delivered to the community quickly and precisely. This helps people to take appropriate action and reduce risks.

3. Post-Disaster Stage

In this research, the Early Warning System (EWS) was not found in the post-disaster stage. This happens because this stage is the recovery and rehabilitation stage. Meanwhile, the Early Warning System (EWS) focuses on disaster risk reduction and mitigation activities.

The implementation of a community-based Early Warning System (EWS) in the pre-disaster and emergency stages shows strong community participation in prevention, mitigation, and response efforts. In the pre-disaster stage, involving the community actively, the Early Warning System (EWS) can be more effective and relevant in reducing the risks and impacts of disasters. During an emergency, the Early Warning System (EWS) which has been agreed upon by the PRB Forum, namely Toa, allows the public to immediately receive information about upcoming dangers. Meanwhile, in the post-disaster stage, the Early Warning System (EWS) was not found because the post-disaster stage was the main task of rehabilitation and reconstruction.

B. Early Warning System Based on Local Wisdom (Local Wisdom Early Warning System)

In the pre-disaster stage, the Gung Pinto Village DRR Forum relied on observations and knowledge of natural signs to obtain early warnings about disasters. For example, changes in animal behavior such as the emergence of large numbers of forest monkeys, the appearance of forest goats, and pangolins, as well as unusual weather patterns, or certain natural phenomena can be an early indication of danger.

Apart from that, there is an early warning system based on local wisdom which is used as shared knowledge in providing information about disaster events. This community-based early warning system was developed through the presence of places of worship, village notice boards, and verbal notifications through people who have special roles in the community's social system such as village heads, traditional leaders, or community leaders.

Furthermore, during an emergency, the Gung Pinto Village DRR Forum uses traditional signals such as special sounds, namely sounds produced from whistles or even church bells as a way to warn residents about the threat of disaster. The traditional signal is used by sounding according to the predetermined Early Warning System (EWS) beat. This is a method that has been passed down from generation to generation and is universally recognized by stakeholders in Gung Pinto Village.

Natural disasters experienced by an area or region can have an impact on infrastructure damage which results in disruption of community social activities, affected victims, damage to the environmental ecosystem, and damaged homes. Therefore, to bridge the delivery of information and messages to the community due to the disruption of communication channels, the community relies on the use of Toa which is used as a public announcement system in the village. This allows important information and instructions to be conveyed to residents quickly.
C. Knowledge Construction of Early Warning System (EWS) Implementation using the Table Top Exercise (TTX) Method

1. Externalization process

The externalization process in knowledge construction in the implementation of the Early Warning System (EWS) using the Table Top Exercise (TTX) method starts from identifying local knowledge followed by identifying scientific and technological knowledge, identifying practical knowledge, and identifying community knowledge. Early Warning System (EWS) implementation can utilize the wealth of knowledge available to increase the effectiveness of early warning systems. By combining knowledge from various sources, synergies can occur that enable the use of comprehensive and relevant knowledge in protecting society from the impacts of disasters.

The objectification process in knowledge construction in the implementation of the Early Warning System (EWS) using the Table Top Exercise (TTX) method is an institutionalization process that activates and strengthens the DRR Forum institutions such as the issuance of DRR Forum Decrees issued by the Village Head and Village Head Regulations (Perkades) for disaster risk management, namely the Disaster Risk Assessment Document (KRB), Early Warning System (SPD), Evacuation Plan (Renvak), Contingency Plan (Renkon) and Disaster Management Plan (RPB). Furthermore, through the internalization stage, people can increase awareness, apply knowledge, participate in training, organize themselves, and integrate safety as a cultural value in everyday life. At this stage,

Obstacles in Implementing the Early Warning System (EWS) as a Disaster Communication Media

a. Resource Limitations

Gung Pinto Village experiences limited resources, such as disaster detection equipment and supporting infrastructure, and a limited budget. As stated by Mr. Rulianto the Regional Facilitator of BPBD for North Sumatra Province in an interview excerpt on May 4 2023 at 11.00 WIB as follows: "Firstly, there was an unstable internet connection, then the meeting time was less efficient because it was held at night. Furthermore, there are limited resources, including budget." Disaster detection equipment is one of the crucial things in efforts to detect disaster threats quickly and accurately. However, these villages face difficulties in accessing and obtaining such equipment due to high prices and limited availability in rural areas.

b. Information Accessibility Limitations

Gung Pinto Village experiences information and technology accessibility such as unstable internet networks. As stated by Mr. Roy Pranata Bangun Head of Gung Pinto Village in an interview excerpt on April 10 2023 at 15.00 WIT as follows: "The internet network is limited, communication access is less stable." In disaster conditions, internet network accessibility is very important. The internet is a means that allows people to connect with the outside world, regardless of their geographic location or physical condition. The internet can be used to access information and services that people in this village need.

c. Limited time

The DRR forum and village government have limited time to prepare training schedules. For people who live on the slopes of the mountains, morning until evening is used for gardening in the fields. So it is not possible to do training at that time. Therefore, meetings, socialization, and training are held in the evening when the community has returned from their gardens. As stated by Mr. Baginta Tarigan the Head of Gung Pinto Village in an interview excerpt on April 18 2023 at 15.00 WIT as follows: "The sissy's time for community meetings, training and socialization is very limited. "Because people are too lazy to take part in the activities of the PRB forum, they just have to force the community to do it and do it." (The time that the community has for meetings, training, or socialization is very limited. Because the community can only take part in the activities that have been arranged by the PRB Forum at night the day when people have finished their work activities). This time limitation affects the ability to complete various tasks, activities, or projects that we want to do. Time limitations can be an obstacle when it comes to setting priorities, dividing time between various tasks, or facing tight deadlines. Limited time can cause delays in completing tasks or meeting commitments.
CONCLUSION
Implementation of the Early Warning System (EWS) as a disaster communication medium involves a community-based approach and local wisdom. The Early Warning System (EWS) is used as a medium for delivering information in the form of training at the pre-disaster stage. At the emergency stage, early warning through communication media such as TOA helps people take appropriate action. The DRR Forum institution also plays a role in organizing and strengthening the implementation of the Early Warning System (EWS). The application of knowledge in people’s lives is the key to the internalization stage. Effective implementation of an Early Warning System (EWS) can reduce risks and protect communities from the impacts of disasters.

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