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EARLY WARNING SYSTEM BASED ON LOCAL WISDOM IN THE GORONTALO AREA

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Abstract
The early warning system based on local wisdom in Gorontalo has the potential and integration with modern technology in disaster management and early detection. Gorontalo is an area that is vulnerable to potential disasters such as floods, landslides, and earthquakes. The local potential of the local community has a hereditary culture that functions as an early warning such as animal observation, natural signs to customary-based conservation practices. Based on observations, there are still many hereditary cultures that have not been well documented so that they affect the sustainability of children and grandchildren in the future. Another factor is that there are still many areas that have not been touched by weather sensor technology or early warning systems, so it needs to be encouraged to become education based on local wisdom. With a system based on local wisdom that has become a culture, it is necessary to integrate this culture in a modern way to be inherited to the community legally. This process is then expected to become documentation for the local community legally so that it can be integrated with technology. The research method is carried out with a qualitative-ethnographic approach focused on exploring the practice of local wisdom with a socio-cultural context. The data collection technique was carried out by an interview process with participatory observation to analyze national and local Gorontalo documents. The expected results are in the form of a database and documentation of gorontao local wisdom in early warning which is carried out based on community conditions.

Keywords: Early Warning System, Local Wisdom, Gorontalo Area

Introduction

Gorontalo is an area with high vulnerability based on its location. Data from the Central Statistics Agency compiled from BNPB shows that in 2023 Gorontalo experienced 21 cases of flooding and 21 cases of drought [1]. Meanwhile, in 2024, it shows that there will be data on 32 cases of flood disasters, 2 cases of landslides, 1 case of drought, and 1 extreme weather [2]. This condition is also exacerbated by the rampant conversion of 103.7 hectares of rice fields over the past 10 years[3].

Historically and symbolically, the people of Gorontalo are based on local wisdom in all aspects of people's lives, including disaster mitigation[4] [5]. Several studies state that the people of Gorontalo have a culture based on local wisdom in some of their activities[6] [7] [8] [9] [10].

This research has then been documented in several

journals so that it is interesting to what extent it is a reference for the local community in Gorontalo. This study then revealed that there is a gap in cultural sustainability to threats to environmental conservation, one of which is: a) There is an information gap from one generation to another [11], b) There are changes in land use that have an impact on environmental conservation [3], c) Lack of integration of warning and early mitigation into the modern social system[12] [13].

Some facts show that the early warning system in Indonesia is limited including: a) The coverage of the area has not yet included all disaster-prone areas[14], b) The response of the community is still lacking by using the application and c) The cost of maintaining the tool reaches a considerable amount [14].

The study conducted by the researcher on the disaster early warning system provides an opportunity for the adoption of local wisdom systems with early warning technology so that it can involve community participation. Based on the gap analysis that occurred, a study is needed that contributes to local wisdom in responding to the disaster early warning system. This study in the future will have an impact on strengthening the early warning system in Gorontalo which will strengthen the locality system to sustainability.

Some research studies on disaster early warning that have been carried out in Gorontalo:

- Local Wisdom from Olele: A Milestone for Maintaining Gorontalo Maritime Culture After the Covid-19 Pandemic [6].
- The Role of Local Wisdom of the Bajau Tribe in Torosiaje Village – Gorontalo in Facing the Threat of Ecological Disasters and Its Implications for Regional Environmental Resilience in the Face of Ecological Disaster Threats[7] .
- Increasing the Awareness of the Bantaran Community in Maintaining Lake Sustainability through the Utilization of Local Wisdom-Based Fishing Gear [8].
- Disaster Mitigation Analysis Related to Social and Culture in Gorontalo [9].
- Social Conditions and Adaptation of the Bajo Tribe to Disasters in Torsiaje Village, Popayato District, Pohuwato Regency, Gorontalo Province [10]

Method

The research method was carried out by mix-method with the following stages:

1. The Qualitative Phase is carried out using an exploration approach of local wisdom [19]
2. The quantitative phase was carried out validation tests with model development [20]

In the implementation in the field, it will be carried out in 4 stages, including:

1. Preparation Stage
   The researcher coordinates with customary institutions to local communities as legal institutions to formulate policies. In its implementation, a literacy survey will be conducted that has been carried out from generation to generation. Furthermore, a database was created regarding informed consent based on local culture.
2. Data Collection
   Visit were made to traditional leaders who act as hereditary oral connectors regarding the local cultural context that has been carried out.
3. System Development
   Session with the community to design a technology ecosystem that is integrated with the cultured of local wisdom
4. Trial and Evaluation

Simulation at several locations and evaluation of responses from community.

Result and Discussion

Result

As is the case in several regions in Indonesia, the local wisdom of Gorontalo plays a role in efforts to be aware (early warning system) and reduce the risk of disasters. A disaster early warning system that utilizes the local wisdom of Gorontalo is believed to be quite effective apart from modern efforts. This is because the early warning system with local wisdom of Gorontalo involves knowledge and practices of traditions and culture. The people of Gorontalo have

believed in the existence of a disaster warning system through two aspects, namely preventive efforts that are carried out without being based on certain "signs" of disaster arrival and efforts based on certain "signs" of disaster coming.

The results of interviews with community leaders/traditional leaders show that the efforts of the preventive early warning system carried out by the people of Gorontalo without being started by a "sign" of the coming of a disaster include various aspects. One of the efforts made is the pattern of building erection (including residential houses) which is carried out by considering certain factors such as geographical factors. This pattern is believed by the community for many years and even for generations to provide protection and resilience to earthquake disasters [9].

According to the belief of the people of Gorontalo (ethnic Gorontalo) that the pattern of erection of the building in question is expected to prevent the building from lightning disasters and have strong durability from the threat of earthquakes. In addition to anticipating disasters for the Gorontalo ethnic community through the pattern of building erection, Gorontalo people from the "Javanese Tondano" ethnicity, also carry out the "Rebo Kasan" ritual as an effort to avoid disasters. For the Tondano Javanese ethnic community, the Rebo Kasan tradition is held on the "last" Wednesday of the month of safar with the aim of asking for salvation from disasters/misfortunes [21] This tradition is an effort by the Tondano Javanese people to reject disasters (the ethnic term is "reject Bala").

Coincidentally, the majority of the Javanese ethnic community of Tondano are Muslim, so the rituals carried out by the residents of the community have Islamic nuances. The activity carried out in the Rebo kasan tradition is that some people take to the streets after the Maghrib prayer to parade while doing dhikr and praying to Allah. In addition, at the intersection there are those who sound the azan. As stated above, the ritual aims to invoke salvation from disasters/accidents.

Furthermore, certain "signs" of the coming of disasters recognized by the public will help the community design a disaster management system according to the capabilities and readiness of available facilities. Signs of disaster are known to community members through, among others: characteristics of natural conditions, behavior of living things including animals, and environmental changes. Based on these signs, the public will be able to know the type of disaster that will be faced so that they will try to prepare themselves to face this type of disaster. Here are some "signs" of disasters that the researchers had summarized, as follows:

Characteristics of Natural Conditions.

Disasters usually cost many lives, so there needs to be an early warning for the community. Although technology can predict several disasters, there is nothing wrong with recognizing the signs before a disaster so that you can immediately secure yourself. One type of disaster that needs to be watched out for is tsunami. A tsunami is a series of waves caused by landslides or large earthquakes that occur both on land and at sea. Tsunami waves can occur 5 minutes to 1 hour after a landslide or earthquake [22]. Therefore, it is necessary to recognize the early signs of the arrival of a tsunami disaster.

From Ehow [22], it was stated that the signs of a tsunami begin with an earthquake. Earthquakes that occur under or near the sea. Earthquakes that cause tsunamis do not only occur in the surrounding area but up to thousands of kilometers away. The next sign is the presence of loud rumbling sounds similar to freight trains. Here, if there is a rapid decline in

sea water and it is not a time when the sea level is receding, then immediately look for a high shelter.

Before a tsunami wave occurs, the seawater will first recede rapidly and then return with enormous force. Similarly, the first tsunami wave is not always the most dangerous. The size of tsunami waves varies and is not the same in all locations. Tsunami waves can also travel through rivers connected to the sea. Finally unusual wind movements, extreme air or weather pressure and changing animal behavior.

Similarly, the signs of an earthquake also need to be recognized from the characteristics of natural conditions. The public still believes that the occurrence of earthquakes can be estimated with a re-period. Thus, earthquake events are often associated with annual cycles. However, it is difficult to predict when and how much an earthquake will occur. Earthquake signs are classified into two, namely tectonic signs and physical signs. However, the strength of the earthquake itself is still difficult to estimate. Until now, geophysics has not been able to predict the timing of earthquakes and the scale of shocks. It needs an early sign that can be used to predict an earthquake.

Behavior of Living Beings

According to local wisdom of Gorontalo, the types of living things that show behavior as signals and signs of disaster are animals and plants. The results of interviews with community leaders/traditional leaders, several types of animals that show behavior as signals and signs of disaster are coming, including: ants, rats, cats, crows, dogs, horses, whales and sharks, snails (land snails), bats, and snakes.

Ants are a type of animal that lives in various places and always lives in groups. The behavior that ants show as a signal of impending disaster is to migrate in groups to higher places. This is in accordance with the belief of the people of Gorontalo that it will give signals and signs of the coming flood disaster around that place. In addition to ants, rats are also believed to be able to provide a sign of the coming of disaster. The behavior shown by rats as a sign of disaster is their activity of making nest holes in higher places. This is believed to be a sign of the coming flood. The next animal that is believed to be able to provide a sign of the coming of disaster is the cat. The behavior shown by cats as a sign of the coming disaster is their activity in groups of cats showing restlessness and even meowing for no reason. This is believed to signal the coming of an earthquake.

Crows are also animals that the Gorontalo ethnic community believes to signal a sign of impending disaster. In the Gorontalo area, the crow population has begun to become scarce. Therefore, the appearance of crows is unusual. According to the community's beliefs, in this case the Gorontalo ethnic community, the appearance of crows in groups provides a harbinger of a disease outbreak that has hit the community.

Another animal that the Gorontalo ethnic community believes shows certain behaviors as a sign of the coming disaster is dogs. In the Gorontalo area, the dog population is quite large with the status of wild animals. Although in Gorontalo some residents keep dogs, there are not many. Gorontalo residents are usually housekeepers or accompany community members to hunt. With respect to disaster signals, the behavior that dogs exhibit as a marker of impending disaster is defecation (defecation) on public streets. This activity is unusual for dogs to do even though they live wild. Thus, if this happens, according to the belief of the people of Gorontalo, this phenomenon is a sign of the coming of the dry season. In addition, the dog's barking activity is not usual and goes out of the cage. It is believed

to signal the arrival of an earthquake..

Horses are also animals that are believed to signal the coming of disaster. Horses are the pets of some Gorontalo people but their current population is minimal and even difficult to find. Previously, when there was still a rampant "bendi" transportation of a type of dokar in Gorontalo, the horse population at that time was quite large because horses were the driving force of the transportation. The behavior of horses related to the omen of disaster is their activity of squealing in groups for no reason. If this happens, according to the belief of the people of Gorontalo it will give a sign of the coming of an earthquake.

Marine animals, in this case sharks and whales, by the Gorontalo ethnic community, are believed to be able to signal the arrival of natural disasters. Part of the Gorontalo area is a marine area where various types of marine animals live, including large fish in the form of sharks and whales. It is believed that if large marine animals migrate to a "very deep" place it signals the arrival of an earthquake.

Snails (land snails) are also a type of wild land animal and are often found in various places both in gardens, flower gardens, and even in flower pots. The phenomenon of snails in connection with the omen of disaster is that their activities gather in relatively high places, such as house walls or fence walls. If that happens, then according to the belief of the Gorontalo ethnic community as a sign of the coming flood. In addition, bats as a type of bird that are active at night and sleep during the day, if they show active symptoms that are not in accordance with their nature, then it signals the coming of disaster. Lastly, snakes are also animals that signal the coming of disaster. When an earthquake is about to occur, the snakes will come out of their nests, even in winter weather.

In addition to animals, plant phenomena can also signal the arrival of disasters. However, the signs that many show are that plant phenomena are more related to volcanic disasters. Changes in soil conditions, such as increased temperatures and changes in chemical composition, can affect the growth and health of plants around volcanoes. Plants exposed to toxic gases or high temperatures can be stressed and even die. This condition can signal the potential for a volcanic eruption.

Discussion

An early warning system for disasters is important for the community, including the people of Gorontalo. With this system, it will help the community prepare for disasters and maybe even avoid them. In line with the development of increasingly sophisticated science and technology, the disaster early warning system is also developing more rapidly. Experts use a variety of advanced equipment to predict and detect the arrival of disasters. Thus, efforts to prepare themselves to face and avoid disasters are easier. Although the disaster early warning system with the help of local wisdom in Gorontalo is still rarely carried out and with minimal references, researchers are trying to find valid information about efforts with the help of local wisdom.

The people of Gorontalo with various ethnicities responded and designed a disaster early warning system in accordance with their respective ethnic traditions. In this study, the disaster early warning system based on local wisdom that will be discussed is the Gorontalo ethnic early warning system and the Tondano Javanese ethnic early warning system. As has been stated, the disaster early warning system with the local wisdom of Gorontalo involves knowledge and practices that exist

in the traditions and culture of the Gorontalo people themselves. Furthermore, the disaster early warning system based on local wisdom in Gorontalo, although it is rarely found, is still rooted in certain places among the community. There are two aspects of the disaster early warning system according to the local wisdom of Gorontalo, namely preventive efforts without any "signs" of the coming of disasters and efforts with signs indicated by certain phenomena. Preventive efforts to implement a disaster warning system in accordance with local wisdom in Gorontalo without any "signs" are carried out, among others, through a "pattern of determining the location of buildings" including residential houses. This is done by considering geographical factors and disaster risk. These considerations are expected to avoid fire disasters, lightning strikes, and the like. Furthermore, the disaster warning system is in accordance with the local wisdom of Javanese Tondano in the form of the "Rebo Kasan" ritual in the form of activities which are carried out on the last Wednesday of the month of safar. The activity was carried out with the aim of asking for safety from disasters/misfortunes and by the Tondano ethnic Javanese community to reject disasters (reject Bala). The activity was in the form of a parade while doing dhikr and munazat to Allah and at the intersection there were people who sounded the call to prayer

Efforts to create a disaster warning system according to Gorontalo local wisdom based on the presence of certain "signs" began with research [9] stating that most respondents can recognize the signs of disaster even though these signs are rarely related to local wisdom in Gorontalo. The signs of the coming of a disaster are known through: the characteristics of natural conditions as well as the behavior of living beings in this case animals and plants.

The characteristics of natural conditions are often used as a sign of the coming of disasters. Signs of a tsunami disaster, for example, begin with an earthquake. Earthquakes that occur under or near the sea do not only occur in areas around the tsunami area but up to thousands of kilometers away. In addition, the presence of loud rumbling sounds similar to freight trains, the rapid subsidence of sea water (not when the sea level recedes) is also a tsunami disaster. Furthermore, the size of tsunami waves varies and is not the same in all locations. Finally, unusual wind movements, extreme air pressure or weather and changing animal behavior are also believed to be signs of a tsunami. In addition to natural symptoms, the appearance of a tsunami is believed to appear by being marked by animal behavior, in this case bats. Bats are able to pick up vibrations or changes in air pressure around the tsunami site. In addition to tsunamis, earthquake disasters can also be recognized by the characteristics of natural conditions. The public still believes that earthquakes are predicted periodically and are related to annual cycles. However, the certainty of the time and magnitude of the earthquake is still difficult to predict. In line with technological efforts, references to earthquake signs according to natural conditions based on local wisdom are still very minimal.

In addition to the recognition of the characteristics of natural conditions, the arrival of an earthquake is recognized by the people of Gorontalo through the signs of the behavior of living beings. According to the local wisdom of Gorontalo as stated above, earthquakes can be recognized

through the behavior of several types of animals such as: cats, horses, marine animals (sharks and whales), and snakes. The behavior shown by cats as a sign of impending disaster is the restlessness of a flock of cats and meowing for no reason. Furthermore, the signs of an earthquake are also shown by the behavior of the horses. The phenomenon that horses exhibit is squealing for no reason. If the horse has been fed and in other comfortable conditions but still squirming, then according to the belief of the people of Gorontalo it will give a sign of the coming of an earthquake. In addition, the behavior of relatively large marine animals such as sharks and whales as a sign of the coming of an earthquake is to migrate to very deep places. Finally, animals that show certain behaviors as a sign of disaster data are snakes.

When an earthquake will occur, the snakes will come out of their nests. In addition to earthquakes, disasters that are no less important will come based on the signs of animal behavior are floods. According to the Gorontalo ethnic community, the sign of the coming flood disaster is shown by the behavior of animals, including: ants, rats, and snails (land snails). The sign that ants show as a sign of the coming flood is that they migrate in groups to higher places. Furthermore, the behavior shown by rats as a sign of impending disaster is the tendency to make nest holes in higher places. This is interpreted as an attempt to save oneself. Finally, the behavior of snails (land snails as a sign of the flood phenomenon according to the belief of the people of Gorontalo if the snail appears in high enough places such as house walls and fence walls.

Another disaster that is believed to appear with a sign of the behavior of living things is the arrival of a disease outbreak. The disaster, according to the Gorontalo ethnic belief, was marked by the appearance of a swarm of crows. The appearance of crows in the Gorontalo area has now begun to be rare.

However, the sudden appearance of a swarm of crows is believed to signal the arrival of a catastrophic outbreak of disease outbreaks. In addition, another disaster that can be recognized through the behavior of living beings is volcanoes. In addition to the appearance of smoke and rumblings on volcanoes, plant phenomena can signal the coming of an erupting volcanic disaster. These changes are seen in the growth and health of the plants that are disturbed. This is due to changes in natural conditions such as increasing temperature and changes in soil chemical composition. Plants that are also exposed to toxic gases or high temperatures can experience stress and even die.

Finally, the disaster that is marked by the behavior of living things according to the local wisdom of Gorontalo is the dry season. According to the beliefs of the Gorontalo ethnic community, the arrival of the dry season is marked by the behavior of dogs that defecate (BAB) on public roads. Although in the Gorontalo area dogs are wild animals (only a small percentage of the community keeps dogs) with a fairly large population, this behavior is unusual. Thus, this behavior by the Gorontalo ethnic community is a strange thing and gives a certain sign that according to the experience of Gorontalo residents is a sign of the arrival of the dry season.

Based on the discussion above, it turns out that the people of Gorontalo have created a disaster early warning system. The early warning system built by the Gorontalo

ethnic community for disasters without any signs includes determining the location of buildings with the aim of anticipating disaster targets such as earthquakes, lightning, fires and so on. Furthermore, build an early warning system with signs that still need validation from the signs that have been presented so that the design of the early warning system still needs further study.

Conclusion

1. To prepare a disaster early warning system based on local wisdom by the people of Gorontalo, efforts are made to prepare a warning system preventively without a sign of the arrival of a disaster and efforts to prepare a warning system based on the arrival of disasters.
2. Signs of the coming of disasters according to local wisdom of Gorontalo include the phenomenon of natural conditions, the behavior of living things (plants and animals) and environmental conditions.
3. Animals that are believed to show behavior as a signal and sign of the coming of a disaster according to Gorontalo local wisdom, including: ants, rats, cats, crows, dogs, horses, whales and sharks, snails (land snails), bats, and snakes.
4. The design of the disaster early warning system is in accordance with the local wisdom of Gorontalo through two aspects, namely the early warning system without starting with a sign of a disaster and an early warning system based on the presence of a disaster sign.

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