Community-Based Disaster Management: A Lesson Learned From Community Emergency Response Management in Banyumas, Indonesia

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Abstract. This article aimed to review community-based disaster management in terms of its independent coordination and disaster management. Community resilience was tested during disaster emergency. While panic, the community is required to be viable and able to evacuate, manage logistic, collect data on damage and the victim, and coordinate with outsiders independently. The community in Gununglurah Village, Banyumas Regency which was hit by a landslide in 2015 provides a lesson learned about community based disaster management. This research used qualitative descriptive methodology with in-depth interview with 23 informants from the community, donor institution, village officers, and government officers. Through traditional and informal methods, the community implemented disaster management that was categorized into 3 mechanisms that were social, functional, and sequential mechanism. These mechanisms controlled different portion in which social mechanism holds the most important role in disaster management, then functional mechanism and sequential mechanism. Various community activities in the village equipped the community with organizational experience to manage logistic, human resource and other coordination. In 2007, in fact, there was vulnerability risk assessment done by the local government, which recommended efforts to be done by the community to reduce the disaster risk, yet it was not implemented. It was interesting to note that in spite of the independent disaster management there was a scientific assessment neglected. Based on this research, a new discussion on how to synchronize the endogenous knowledge with scientific modern knowledge was opened.

Keywords: CBDM, Emergency Response, Community Resilience

1. Introduction

Indigenous knowledge refers to the methods and experiences developed by a group of community that understands the local environment, which has been established from previous generations [1–3]. This knowledge consists of several different characteristics of other knowledge[4–6]. Such as Komino [7] who conducted endogenous knowledge research in Pakistan, concluded that endogenous knowledge consists of 3 categories namely; social mechanisms, functional mechanisms and sequential mechanisms. Broadly speaking, endogenous knowledge is closely related to the character of the community [8], as well as the character of the region that has different customs, which cannot be
generalized [9]. This means that every disaster event must have a local investigation process before disaster management program is carried out.

Indigenous knowledge consists of the community itself, it preserves the shared cultural values established from previous generations, and becomes an embedded adaptation tool as a means of community survival [10,11]. Even before the disaster risk reduction using advanced technology-based early warning system, or using the standard operating procedures countermeasures, many local communities around the world have been equipped with readiness, on how to act and cope with natural disasters using endogenous knowledge passed down from previous generations [1].

The correlation between indigenous knowledge and natural disasters has been growing and increasingly attractive in recent years [8]. Indigenous knowledge is specific culture, and it describes the lifestyle of the society. Thus, the spread and development of indigenous knowledge becomes an interesting issue [1]. Some researches confirm that the principle of indigenous knowledge may be applied to different locations, which require conformity with local culture. Implementation is a process and requires the participation of broader stakeholders and public policy [12,13].

This research investigates the indigenous knowledge in Gununglurah Village, Cilongok District, Banyumas Regency. Indigenous knowledge is important because it contributes not only as a small influence, but has a sustainable role [1]. In completing this research, it is necessary to understand and acknowledge indigenous knowledge as one of the important sources of information and contributors in disaster risk reduction in every part of the world [14,15]. This study aims to raise awareness of indigenous knowledge as an effective method of disaster risk reduction. The results of this study can contribute as a proposal of the Resilience Village program in Gununglurah Village.

2. Research Method

The research method used in this research was qualitative research. The data collection methods in this qualitative research among others were data collection in a natural setting as the primary data sources. Data were mostly collected through in-depth interviews, observation, and documentation. Qualitative data obtained was non-numerical data such as customer satisfaction (very satisfied, satisfied, dissatisfied and so on), so mathematical operations cannot be applied. Qualitative data were data related to categorization. Its characteristics were in the form of questions or in the form of words [16].

The object of this study focused on how communities cope with landslide disaster based on knowledge and experience passed on from previous generations and categories of indigenous knowledge according to Komino [7]. The data were collected by using snowball sampling technique that was by conducting interviews to people/institutions who are competent in their fields and are considered to represent the object of the research (see Figure 1) [16]. This snowball technique is done with the key person of Village Hall of Gununglurah because he has comprehensive data for the chronology of the landslide, the stakeholders involved, and the activity of the community in coping the landslides.

In this qualitative research, the data processing was done by using data reduction, data selection process, data simplification, and rough data transformation emerging from records written on the field [16]. Data reduction was done by creating a summary, searching for themes, and coding and composing verbatim interviews (see table 1). Here are the informants and the target information that was done in the interview. In addition to the interviews, the data collection method was through observation. Observation was conducted to identify the characteristics of landslide disaster and to identify the condition after landslide disaster of Gununglurah Village. On the other hand, the secondary data collection was through the documents study and online data search.
Figure 1. Snowball’s Interview Flow

Table 1. Data Collection and Interview Method

| No | Informant                              | Target Information                                                                 |
|----|----------------------------------------|------------------------------------------------------------------------------------|
| 1. | Landslide Victims                      | • Characteristics of landslide disaster  
|    |                                        | • Community disaster management procedures                                      |
|    |                                        | • Aid from outsiders of Gununglurah Village                                       |
|    |                                        | • Coordination between communities in coping with landslides disaster             |
|    |                                        | • Technical strategy of community in coping with landslide disaster               |
|    |                                        | • The traditional method applied by community in coping with landslide disaster   |
| 2. | Community Leader I (Small Committee)   | • Disaster mitigation mechanism                                                   |
| 3. | Community Leader II (The Head of RT 05)| • Division of work of village apparatus and community leaders                     |
|    |                                        | • Coordination in disaster mitigation                                              |
| 4. | Community Leader III (The Head of RW 01)|                                                                                   |
| 5. | Head of Gununglurah Village            |                                                                                   |
| 6. | Village Officers of Gununglurah        |                                                                                   |
| 7. | Head of Dusun I                        |                                                                                   |
|    | Head of Prevention and                 |                                                                                   |
|    | Preparedness BPBD Banyumas Regency     |                                                                                   |
| 8. | Section Head of Satpol PP Cilongok     |                                                                                   |
|    | District                               |                                                                                   |
3. Results and Discussion

Based on the analysis, it is obtained that many stakeholders were involved in disaster mitigation. In addition to stakeholders, there was certainly a mechanism that was done in the prevention of landslide disaster as well as indigenous knowledge of local communities.

3.1. Landslide Risk Level

Figure 2 shows the map of landslides risk zone in Gununglurah Village which was created based on land use map overlay and map of ground movement vulnerability of Gununglurah village [16].

3.1.1. The High-Risk Zones of Landslide Disaster

It was found in the settlement area because there was threat to human’s life and to the productive cultivation in the settlement area. High risk zones of landslide disaster are located in the middle and southern part of Gununglurah Village.

3.1.2. The Medium Risk Zones of Landslide Disaster.

Located in residential areas with low land vulnerability and agricultural lands such as rainfed ricefields, irrigated fields, gardens, and Palawija farm located in highland soil susceptibility zones. The landslide risk zone covers most of Gununglurah Village.

3.1.3. The low risk zones of landslide disaster.

Located on agricultural, plantation and forest lands in low land vulnerability zones. Low landslide risk zone covers a small part of the north, a small part in the middle, and a small part on the south of Gununglurah Village.

3.1.4. The Very Low Risk Zones of Landslide Disaster.

It is located in settlement areas, agricultural lands, plantations and forests in very low land vulnerability zones. The very low landslide risk zone covers the central part of Gununglurah Village. The community felt that the landslide which has been occurring has been classified as a small landslide or has a low level of risk because it has never resulted on casualties, as did the landslide disaster that occurred in Mr. Tohari’s destroyed house. Please note that the point of landslide disaster that hit Pak Tohari’s house was in the medium risk zone of landslide disaster.

The role of parties involved in disaster management. The role of the parties involved in dealing with landslide disaster management activities in Gununglurah Village was very diverse. Many parties, both internal and external, were involved in the management of landslide disaster in Gununglurah Village. The role included three forms, including: (1) Roles related to disaster management, (2) Roles related to evacuation and rehabilitation of buildings, and (3) Roles related to raising public awareness. The role of landslide disaster management was in the form of data collection of victims, data collection of basic needs of the community, coordination with stakeholders related to the decision of the flow of landslide management mechanism in Gununglurah Village. The coordination was a formation of small committees. The small committee was a group of community leaders who had the initiative to manage the incoming aid and provided more assistance for the victims of landslide disaster in Gununglurah Village (see Table 2).

The role of evacuation and rehabilitation of buildings was mostly done by members of the TNI (The Indonesian Military), PMI (the Indonesian Red Cross), police officers, Pemuda Pancasila,
members of community protection (linmas) and members of the PKK (the Family Welfare Movement). In the implementation of this evacuation and rehabilitation of building, they served as volunteers and always coordinated with small committees. The activities undertaken was the relocation; evacuation of the people of Gununglurah Village to a safer place (see Table 3).

The role for public awareness improvement was mostly done by BPBD of Banyumas Regency. Activities in the form of socialization and simulation were carried out regularly to ensure the public was ready for landslide disaster. In addition to BPBD of Banyumas Regency, Social Agency and Banser NU (the youth wing of Nahdlatul Ulama) also provided assistance. The efforts included socialization, spiritual refreshment and motivation of spiritual support (see Table 4).

![Figure 2. Map of Landslide Risk Zone](image-url)
Table 2. Duties of the Small Committee

| NO. | MAIN DUTY                     | DETAILS                                      | PERSON IN CHARGE     |
|-----|-------------------------------|----------------------------------------------|----------------------|
| 1.  | Data collection               | • Listing initial needs                      | Refreshment division |
|     |                               | • Listing the incoming aid                   | Treasurer            |
| 2.  | Coordination                  | • Information landslide disaster             | Chairman             |
|     |                               | • Volunteers                                 |                      |
|     |                               | • Incoming aid                               |                      |
|     |                               | • Fund                                       |                      |
| 3.  | Proposal submission           | Submitting a fund proposal to rural level PNPM (National Program for Community Empowerment) | Licensing Division |
|     |                               |                                              | Secretary            |
| 4.  | Rehabilitation and reconstruction | Recruitment of carpenters or builders         | Security division    |

Table 3. Types of Aids from Various Donors to Gununglurah Village

| No. | Types of Aids   | Helpers                                                                 | Beneficiary                                      |
|-----|-----------------|-------------------------------------------------------------------------|--------------------------------------------------|
| 1.  | Health services | Indonesian Red Cross, BPJS Kesehatan (The Healthcare and Society Social Security Agency) | Gununglurah Village                               |
| 2.  | Staples         | BPBD (Disaster Mitigation Agency) of Banyumas Regency, Small committee Indonesian Red Cross |                                                 |
| 3.  | Money           | Rural level PNPM, Ministry of Religious Affairs, BadanAmil Small committee Zakat (alms agency), Banyumas District Head, Gununglurah Village Residents, Schools in Cilongok Sub-district |                                                 |
| 4.  | Livestock       | Agency Amil Zakat                                                        | Society                                          |
| 5.  | Building material | BPBD of Banyumas Regency                                                 | Small committee                                  |
| 6.  | Shelter         | Villagers of Gununglurah Village                                         | Society                                          |

Table 4. The Role of Institutions in Increasing Public Awareness

| No | Types of Aids   | Helpers                  | Beneficiary |
|----|-----------------|--------------------------|-------------|
| 1  | Socialization   | BPBD of Banyumas Regency | Society     |
| 2  | Spiritual refreshment | Banser NU               | Small committee |
| 3  | Motivation and psychological support | Social Agency | Society     |
Figure 3 shows the flow mechanism of landslide response. The mechanism of landslide disaster management done by people of Gununglurah Village is based on Disaster Management Cycle according to Law Number 24 Year 2007 which is included in the emergency cycle. There is no formal disaster management mechanism by the community, but when there is an emergency status, they use a mechanism of mitigation which is called a logistic mechanism [17]. The logistic mechanism undertaken by the community is categorized into 3 phases, including phase of readiness. It is community readiness to assess rapidly and accurately in the determination of disaster emergency status which consists of several aspects such as location, damage, loss, resources, logistics, and donors. In addition, there is a phase of disaster response that is a community activity related to the rescue and evacuation of disaster victims. The last phase is the phase of reconstruction which is a community activity related to rebuilding or recovering post-disaster victims.

The logistic mechanism carried out by the community in coping with landslide disaster in Gununglurah Village in the first phase needs to be improved. Community readiness only fast assessment of a disaster emergency status in terms of location [17]. There is no assessment of the performance of suppliers, logisticians, and other donors to make the emergency response phase effective. It is necessary to be careful in reviewing the market price during a disaster event in the previous years to prepare the relief supplies as the price of goods changed dynamically.

Second, the phase of landslide disaster management by the community in Gununglurah Village during the phase of emergency response is good. The community has made good efforts during the emergency response and there is a need for accuracy in estimating the inventory during the process of distribution which is stored in the warehouse for the adjustment of needs. Third, the logistic mechanism carried out by the community in coping with landslide disaster in Gununglurah Village in the phase of reconstruction needs to be improved. Aid accountability is needed in order to establish good relationships with donors because the villagers of Gununglurah Village also need assistance from outsiders. The evaluation of emergency response performance is also needed so that the public obtains a lesson from the shortcomings and mistakes that will be useful in the future.

3.2. The Analysis of Community’s Indigenous Knowledge

According to Komino [7], indigenous knowledge that applies in Gununglurah Village community is divided into three categories, namely social, functional, and sequential mechanism. Social mechanism can be categorized into two forms, including internal communication and coordination.
The form of internal communication and coordination is the initiative of the community itself to hold meetings in anticipating disasters and take action when a disaster occurs. There is no special division of roles and it is done internally by Gununglurah Village community aims to reduce the risk of landslide disaster. Next is external communication and coordination. The form of communication and external coordination is the form of communications conducted by villagers of Gununglurah village in whom the village officers report when they really need assistance of the Regional Disaster Management Agency of Banyumas Regency (BPBD of Banyumas Regency) and other formal institutions. In addition, there is coordination of the Small Committee with the National Program for Community Empowerment in Rural Area (Rural PNPM) related to additional funding aids.

The second indigenous knowledge is functional mechanism. Based on the indigenous knowledge, the functional mechanism category that has been implemented by the people of Gununglurah Village consists of three components. Among others is the building structures adjustment. The form of building structure adjustment done by some people is by strengthening the walls to make the house stronger to reducing the risk of damage to the building. The other is repairing the roof of the house so that the water can flow directly to the drainage. In addition, some people no longer make buildings or houses on steep hills. Furthermore, the other form is environmental engineering. Environmental engineering undertaken, among others, are tidying up trees and sloping steep cliffs to reduce the risk of landslide. Besides, the community no longer makes the pond on the hill and also dismantles the pond that has been built. The third component is local technology. Local technology means that the community is doing some activities such as monitoring during rain for its duration and intensity. The other is the construction of permanent drainage channel so that the water does not dribble into the soil that causes the soil to erode. The next is closing the cracks above the mountain cliffs in case of heavy rain for more than two hours and sending a report if there is a crack.

The third indigenous knowledge is sequential mechanism. Indigenous knowledge of sequential mechanism category is indigenous knowledge related to the traditional way of community in disaster management. It includes not to affecting the livelihoods or changing livelihoods although landslide disaster in Gununglurah village is common thing to happen. There is also no migration. There is only change in the consumption and food source after landslide disaster in Gununglurah Village. The type of food given is fast food.

**Findings.** Indigenous knowledge related to community technical strategies in independent disaster management has some misperceptions such as bamboo tree cutting activities as one of the technical strategies done by the community. It is because of the lack of public knowledge about the environment. In fact, bamboo trees can serve as one of the early warning systems to landslides [18].

The bamboo cutting trees is also one of the findings that should be utilized by the people of Gununglurah Village. Please note that bamboo trees functions to maintain ground water, and its roots are able to withstand landslides, and its leaves are capable of splitting the wind or dampening noise and dust pollution [18]. Indigenous knowledge related to the traditional way of community in disaster management is not always effective as a disaster management strategy and is always subject to change depending on environmental conditions.

4. Conclusion

In accordance to the goals and objectives to be achieved from various analyzes related to the category of community’s indigenous knowledge in the landslide disaster management, it can be concluded: Gununglurah Village has 4 levels of landslide risk zone; (1) high risk landslide zone, (2) medium risk landslide zone, (3) low risk landslide zone, and (4) very low risk landslide zone. Most of Gununglurah Village is included in the medium risk landslide zone. The point of landslide that hit Pak Tohari’s house was in the zone of medium risk of ground movement and was included in the medium
risk landslide zone causing the house to be destroyed. The social mechanism of the community in coping with landslide disaster in Gununglurah Village is divided into 2 forms, namely internal communication and coordination, and external communication and coordination. Social mechanism has the most dominant role compared to other indigenous knowledge mechanisms. This is due to the character of the rural community groups which have a high social spirit. The functional mechanism of the community in coping with landslide disaster in Gununglurah Village is divided into 3 aspects, namely building structure adjustment, environmental engineering, and local technology. There is a need for the community to have a deeper knowledge of the environment and structural mechanisms [19]. There are no prominent community’s sequential mechanisms in coping with landslide disaster in Gununglurah Village because the community thinks that the incoming aid is adequate and they feel that the type of landslide that occurred is not risky enough.

Social mechanisms, functional mechanisms, and sequential mechanisms are interconnected and not stand by themselves. In every activity carried out in disaster management area, the community always coordinates, communicates, and works together. There is an informal mechanism that applies in disaster management by communities in Gununglurah Village. The mechanism was initiated by the community by forming a small committee consisting of the head of RW, head of RT, and some ad hoc community leaders. The small committee has an important and dominant role in every disaster management activity in Gununglurah Village and always coordinates with relevant stakeholders.

It is recommended to improve the community’s indigenous knowledge and gain social learning [16] in landslide disaster management in Gununglurah village. Then some recommendations are formulated for the public and stakeholders. The recommendations include: (1) Affirmation of strategic policies related to natural disasters in Gununglurah village, for example, by mapping any vulnerable areas and the prohibition of settlement construction in the area [20]. These can minimize the risk of landslide disaster; (2) Preparation of disaster evacuation route in every region which also needs to be done so that it can minimize disaster victim; (3) Enforcement of stricter laws and programs that promote public participation and awareness of the risks of landslides [19]; (4) Improvement of school facilities and infrastructure and socialization of the importance of education to the people of Gununglurah Village to improve the education level; (5) The development of local economy without being dependent on natural resources also needs to be done so that the economic capacity of the region is increasing. Economic capacity affects the ability to adapt because high economic capabilities can support the functional mechanism required in the technical strategy of disaster management; (6) Routine socialization and simulation for the community related to natural landslide disaster in Gununglurah Village, so that people’s understanding and awareness of natural disaster is also improved. With the large population of children, the elderly and the low-educated population and the high poverty rate, it needs more understanding towards the community about the prevention capacity so as to improve its adaptability; (7) The community is expected to improve the awareness in maintaining the environment, so as to minimize the occurrence of disasters, especially those caused by climate change.

To examine community activities in landslide disaster management in Gununglurah Village, then some recommendations for researchers are formulated for further research. The recommendations include: (1) Assessing the financial mechanisms in the prevention of landslide disaster in Gununglurah Village, (2) Reviewing the community’s indigenous knowledge during pre-landslide disaster in Gununglurah Village, (3) Reviewing the community’s indigenous knowledge after the landslide in Gununglurah Village, (4) Assessing gender roles in the management of landslide disaster in Gununglurah Village, and (5) Assessing the level of vulnerability of Gununglurah Village to landslide disaster.
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