Al-Kharaj: Journal of Islamic Economic and Business
Volume 6 (4), 2024: 625 - 637
P-ISSN: 2686-262X; E-ISSN: 2685-9300

Optimizin Communiy-Based Landslide Emergency Management at Curug Cilember, Indonesia: an ISO 45001-Oriented Approach

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Received: 24 April 2024

Revised: 9 November 2024

Accepted: 30 December 2024

Abstract

This study aimed to evaluate the landslide emergency management system at the Curug Cilember tourist site, Megamendung District, Bogor Regency, with a focus on the role of local community participation and optimization strategies based on ISO 45001 standards. A qualitative descriptive method was applied, using interviews, field observations, and literature studies, with purposively selected informants relevant to the research context. The results show that the emergency management system includes cross-sectoral planning, implementation through simulations and training, and regular evaluations involving community discussions. The findings highlight key supporting factors such as the presence of disaster-resilient village programs, while identifying obstacles including limited coordination, budget constraints, and low public awareness of landslide risks. Optimization strategies involve strengthening emergency communication, providing regular community-based training, improving evacuation infrastructure, and implementing ISO 45001-based procedures. In conclusion, the synergy between tourism managers, local communities, and visitors is essential to establish an effective and sustainable emergency response system that enhances disaster preparedness and community resilience.

Keywords: *Community participation, Cilember Waterfall, ISO 45001, Landslides, Emergency management.*

INTRODUCTION

Landslides are a natural process that contributes to the formation and change of the earth's landscape (Dahal et al., 2024). However, in the modern context, landslides are a serious threat that is increasing along with climate change and accelerated urbanization in various parts of the world. This disaster occurs in areas with high rainfall and vulnerable geological structures, such as mountainous areas and steep slopes. Although generally associated with geological factors, heavy rain and changes in land use also trigger landslides (Tjahjono et al., 2024). The impact of landslides is very large, including human losses, material losses, and environmental damage. The complexity of the relationship between humans and the environment can be seen from the activity of utilizing natural resources, which aims to meet the needs of life, often worsening the condition of the ecosystem, for example through deforestation and land conversion. In this case, an ecosystem approach to disaster prevention is important to understand the extent to which nature can help reduce the impact of disasters (Munajati et al., 2022b). The increasing frequency of landslides marks the need for more systematic and participatory mitigation efforts (Haribulan et al., 2019).

https://doi.org/10.24256/kharaj.v6i4.6572

Globally, the impact of landslides is not only destructive to nature, but also causes huge economic losses. In India, landslides after heavy rains caused widespread damage, and in South Africa and Pakistan, floods resulted in thousands of deaths. Indonesia, as a tropical country with high rainfall, is very vulnerable to this disaster, especially in areas such as West Java (Sarah et al., 2024). The National Disaster Management Agency (BNPB) explained that West Java is one of the provinces with the highest landslide incidence rates, which has direct implications for economic stability and public safety. Bogor Regency is one of the most landslide-prone areas according to the Center for Volcanology and Geological Disaster Mitigation (PVMBG) (Siswo Hadi Sumantri et al., nd). Data from the Bogor Regency BPBD shows that there were 1,154 landslide incidents from 2019 to 2021 (Herdiansyah et al., 2024). One of the critical points is the Curug Cilember tourist area in Megamendung, although it has high tourist attractions, it is highly vulnerable to landslides, especially during the rainy season. Steep geographical conditions, narrow road access, and dense settlements exacerbate the risks. Changes in land use in Cisarua, Ciawi, and Megamendung also add to the complexity of the problem (Munajati et al., 2022a).

Another obstacle faced is the weak coordination between the government, tourism managers, and the local community. Disaster management infrastructure such as evacuation routes and early warning systems are not optimal. The lack of public and visitor awareness of the importance of preparedness also worsens the situation (Hatibe et al., 2021). Disaster experiences have been shown to increase individual preparedness to face similar events (Saputra et al., 2021), but ongoing education remains the main key. One effort that can be made is to implement international safety standards such as ISO 45001. This standard can help in managing disaster risks in tourist areas, although its implementation in Curug Cilember is still limited (Tudies, 2018). The participation of all parties, including the community, tourism managers, and the government is very important to create an ideal emergency response system (Harist et al., 2019). The basic principles of disaster management include the active participation of all stakeholders in the planning, implementation, and evaluation of emergency response strategies. This study aims to optimize landslide emergency response management in the Curug Cilember tourist area, Megamendung, Bogor Regency. The main focus of the study is to evaluate the implementation of the emergency response management system, analyze the role of the community and RT/RW in increasing preparedness, and formulate disaster mitigation optimization strategies involving various parties. With an integrated approach and based on ISO 45001 safety standards, it is hoped that this area can become a safe and disaster-resilient tourist destination (Morgado et al., 2019).

METHODS

The study uses qualitative methods and descriptive qualitative approaches to optimize the application of research objects in depth. The research method involves collecting data through literature studies and interviews with experts, communities and practitioners. The reason why researchers choose qualitative research methods is because they aim to understand the phenomenon by considering community perceptions. The method of collecting descriptive data through techniques such as interviews, observations, and text analysis. This approach is more flexible and easy to adapt, providing opportunities for researchers to be responsive to the characteristics of the research context in tourist attractions. For the qualitative approach to answer the objectives of assessing the implementation of landslide emergency response management in the Curug Megamendung Puncak Bogor City tourist area. Identifying the participation of village communities and RT / RW in Curug Megamendung Puncak Bogor City. Compiling recommendations to overcome obstacles in landslide emergency response by involving managers, communities, and visitors to continue to comply with ISO 45001 occupational safety and health standards.

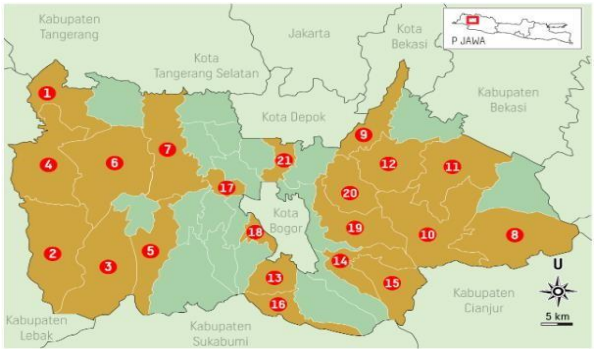

Figure 1 Research Location (14) is the Megamendung research location, Bogor Regency, West Java, Cilember Waterfall tourist attraction, Puncak.
(Source: Bogor City Regional Disaster Management Agency, 2023)

The study used two populations, for the first population, namely tourism managers, communities, visitors and has the aim of researching the increase in participation of village communities and RT/RW. The second population is aimed at experts who have technical emergency response capabilities that are used by organizations consistently. Therefore, researchers will consider several criteria to determine informants according to research questions. Purposive sampling is done using various methods to obtain possibilities in a specific and difficult-to-reach population.

Table1. Informant Criteria

Population	Informant Criteria	Utility	Amount (Person)
Tourism organizations implementing Cleanliness, Health, Safety, and *Environment Sustainability*	1. Tourist attractions have the potential for landslides. 2. Tourist attractions that implement emergency response management. 3. Organizations that lack emergency response infrastructure.	Representing the views of tourism management regarding landslide emergency response.	3
Community Leaders, RT/RW and Communities around tourist attractions	1. Everything the public knows about landslides and emergency response 2. Role of society 3. The impact of landslides on the environment. 4. Impact of landslides on traders' income	Representing the views of the community to increase emergency response participation.	15
Visitors	1. The role of landslide emergency response visitors 2. Visitor response to landslide	Representing visitors to increase emergency response participation	5

(Source : Researcher Processing, 2023)

Table2. List of Informants

Population List	Amount
ISO 45001 SMK3 Practitioner	1 Person
ISO 45001 SMK3 Consultant	1 Person
ISO 45001 SMK3 Auditor	1 Person
Academics	1 Person

(Source: Researcher Processing, 2023)

Table 3. Informant Criteria

Population	Informant Criteria	Utility
ISO 45001 Management System Auditor	1. Minimum 5 years experience as Lead Auditor 2. Minimum 5 years experience as SMK3 Auditor 3. Have 5 years experience as Lead Auditor ISO 45001: 2018	To be a representative of the views of the parties who have conducted CHASE
Academic in the field of ISO 45001 Management Systems	1. Have 5 years experience in the field of K3 mmal 2. Becoming a mall K3 emergency response instructor 5 years	As a representative of academic input and views
ISO 45001 management system consultant	1. Have 5 years experience as SMK3 consultant 2. Lead SMK3 Consultant 3. Lead Consultant ISO 45001	Representing the views of the parties, sharing opinions and assisting in the implementation of ISO 45001
ISO 45001 Management System Practitioner	1. Have 5 years experience as a K3 management system consultant 2. Lead Consultant on SMK3 3. Lead Consultant ISO 45001	As a representative and practical view of implementing ISO 45001

(Source: Researcher Processing, 2023)

Table3. Research Variables

No	Variable Name	Operational Definition of Variables	Measurement
1	Barriers to implementing emergency response	Understand internal and external issues by knowing the strengths, weaknesses, and threats of disaster in the organization.	Literature study, field verification through interview observation
		Increase leadership involvement in implementing procedures.	
		Reducing environmental impact by achieving procedures.	
		Improved implementation system and disaster prevention	
2	Emergency Response Management	Speed of response, coordination between agencies, resources, effectiveness of communication, evacuation, and fulfillment of basic community needs.	
		Risk mitigation, asset protection, repair, recovery, and sustainability maintenance.	
		Ecosystems, natural resources, biodiversity, air quality, water, sustainability	
		Compliance with instructions, guidelines, rules, organizational actions to address emergency situations	
3	Village Community and RT/RW Participation	Compliance with disaster procedures	
		Safety culture and disaster awareness	
		Disaster management awareness	
		Community Understanding	

(Source: Researcher Processing, 2023)

Table4. Research Data Matrix Table

No	Data Name	Data source	Collection Instruments
1	Emergency response to landslide disaster	Textbooks, journals, theses, articles	Literature study, field verification through observation, interviews
2	Emergency Response Communication	Textbooks, journals, theses, articles	Literature study, field verification through observation, interviews
3	CHASE Readiness Management Concept for XYZ Tourist Attraction	XYZ tourist attraction and experts	Literature study, field verification through observation, interviews
4	Expert knowledge	Expert	Literature study, field verification through observation, interviews
5	K3 Performance at XYZ Tourist Attraction	XYZ tourist attraction	Literature study, field verification through observation, interviews
6	Participation of village communities and RT/RW	Textbooks, journals, theses	Literature study, field verification through observation, interviews

(Source: Researcher Processing, 2023)

RESULTS AND DISCUSSION

Evaluation of the Implementation of Landslide Emergency Response Management at the Curug Cilember Megamendung Tourist Attraction

Determination of Landslide Emergency Status

The emergency response to the landslide at the Curug Cilember tourist attraction began with determining the emergency status based on the results of a rapid assessment. The assessment was carried out by the internal emergency response team of the tourism management to assess the

severity of the disaster, which determines the scale of handling, whether it is sufficient at the local level such as the village or sub-district, or whether it is necessary to involve the National Disaster Management Agency (BNPB). This decision depends on field conditions and identified risks. If the severity is high or requires additional resources, the emergency status can be increased to involve BNPB. However, small-scale disasters are generally handled at the local level with a relatively short emergency response duration, around 1-2 days. The emergency response process is often hampered by the weather, such as rain that can trigger further landslides, so that land clearing or evacuation of victims is temporarily stopped to avoid additional risks. Coordination with the Bogor Regency BPBD is carried out if an extension of the emergency response time or heavy equipment support is needed. However, the emergency response system at Curug Cilember showed several inconsistencies with BNPB procedures, such as a rapid assessment that was only carried out by an internal team without involving BPBD or BNPB, and the determination of emergency status that did not always refer to structured BNPB standards. The level of response is often based on local decisions without systematic risk analysis, while the duration of emergency response is not always consistent with BNPB recommendations..Weather management in emergency situations is also an obstacle. When heavy rain occurs, emergency response activities such as land clearing or evacuation are often stopped without specific weather mitigation guidelines, so that the disaster management process is less than optimal. The main factors causing this discrepancy include limited resources, lack of knowledge about BNPB procedures, and coordination that has not been fully integrated between tourism managers, BPBD, and BNPB. Based on the results of interviews with managers and emergency response teams, they stated that the status of a disaster emergency is determined to estimate the duration of response and evacuation of victims. This determination also allows for better coordination with BPBD if the emergency response time needs to be extended.

Rescue and Evacuation of Affected Communities

The rescue and evacuation process for people affected by the landslide at Curug Cilember involved various parties, such as SAR, TNI, Polri, BPBD, and disaster volunteers, with the main coordination under the management of the tourist attraction and BPBD of Bogor Regency. Based on an interview with Mrs. Uci as the tourism manager, all components of society participated in this process, from searching for victims to fulfilling basic needs. Disaster logistics, including food, tents, and equipment, were managed by the Social Service and Food Security Service. BPBD acted as the main coordinator to ensure the smooth running of the emergency response process without direct authority over fulfilling basic needs. The rescue process also included fulfilling the needs for

clothing, food, and shelter, which according to the confessions of local traders such as Mrs. Ipah and Mrs. Iin. Fulfilling basic needs is a top priority, especially because landslides often damage public facilities, such as traditional traders' places of business and access to clean water. Based on the results of interviews and observations, the affected community was satisfied with the quick response from the tourism manager, BPBD, and related agencies in handling the disaster. The distribution of logistics handed over to the Social Service and Food Security Service was also considered quite effective, although there is still potential for delays if coordination does not run smoothly. Protection of vulnerable groups, such as children, the elderly, and pregnant women, has been a priority in the rescue and evacuation process at Curug Cilember, in accordance with the standard operating procedures of tourism managers and Law Number 24 of 2007 concerning Disaster Management. According to visitors, vulnerable groups are always prioritized during the rescue process, because they are at higher risk of disaster impacts. This procedure is considered effective, although in small-scale disasters the implementation of protection for vulnerable groups is not always optimal. Landslides at Curug Cilember are usually small-scale, with limited impacts on one or two houses, as conveyed by Darmono, Site Manager of Curug Cilember. This small-scale handling allows for a quick response, including with the support of heavy equipment if needed.

Restoration of Vital Facilities and Infrastructure

Vital facilities and infrastructure such as clean water, electricity, and other supporting facilities are very important when a disaster occurs, including in the Curug Cilember tourist area. The restoration of this infrastructure is the main priority of the emergency response team and the Bogor Regency BPBD, who work together to ensure the smooth running of the rescue and evacuation process. According to Mr. Darmono, Site Manager of Curug Cilember, the restoration includes opening clean water channels, providing bathing places for evacuees, restoring electricity and communication networks, and clearing access roads that are blocked by landslides. Without rapid recovery, the community will have difficulty meeting basic needs, while economic activities will also be disrupted. This recovery process is considered to have gone well. Based on an interview with Mr. Sidik, the tourism manager, the emergency response team managed to restore road access and ensure the availability of logistics, such as food and clean water, even though the victim rescue process is ongoing. Field observations also show that the debris from the landslide has been cleared quickly, although there are still vulnerable points that have not been handled optimally, such as the construction of retaining walls. Vital facilities and infrastructure that are the focus of recovery include several main elements, namely clean water for consumption and hygiene, electricity for

lighting and communication, health facilities for emergency response, road access for mobility, and telecommunications networks for coordination. Based on interviews and observations, tourism managers and BPBD have met operational standards by ensuring that all of these needs are available during the emergency response. The main stakeholders involved in the recovery of facilities and infrastructure include tourism managers, BPBD, the Social Service, the Food Security Service, and the local community.

Participation of village communities and RT/RW in improving landslide emergency response at the Curug Cilember tourist attraction

Planning Phase

The participation of village communities and RT/RW plays an important role in landslide mitigation and emergency response planning, especially in vulnerable areas such as Curug Cilember. Their involvement helps ensure effective coordination in disaster mitigation efforts. Collaboration between RT, RW, Village Head, and BNPB aims to improve community preparedness and a fast and efficient response. Based on an interview with Mr. Capung on April 21, 2024, the community explained their active participation in emergency response without having to wait for instructions from the sub-district or BPBD. The disaster-resilient villages that have been formed in the area allow the community to act immediately to evacuate when a disaster occurs, demonstrating their readiness to face disasters. The results of the mapping in the Megamendung area also show that the disaster-resilient village program has been running well, with regular education and training provided to the community. According to Mr. Jajang, the community has gained an understanding of the importance of maintaining the cleanliness of water channels and not littering to reduce the risk of flooding and landslides. This socialization is carried out by the village head every year through routine events, focusing on emergency response procedures and disaster mitigation. Mr. Ilyas, the policy of cleaning irrigation channels and appeals to protect the environment are implemented to increase community participation in disaster prevention efforts before the rainy season. However, several speakers, including Mr. Iman and Mr. Andi Sugandi, stated that socialization from tourism managers regarding landslide mitigation still needs to be improved. Although initial steps such as evacuation to safe areas and increasing awareness of high rainfall have been carried out, the implementation of this socialization is still considered ineffective by some people. Other speakers, Mr. Acep and Mr. Iwan, added that the community needs to be continuously reminded of the importance of monitoring water channels and taking preventive measures during heavy rain, especially for those who live near steep cliffs.

Disaster mitigation activities at Curug Cilember also include training, simulations, and emergency response trials.

Community Participation in the Implementation Phase

Community participation in the implementation of disaster mitigation at Curug Cilember is a continuation of the previously prepared planning stage, covering aspects of planning, implementation, and objectives. Community involvement is very important at this stage, either through contributions of manpower, funds, or constructive ideas. Based on disaster management theory, community involvement at the implementation stage is the key to the effectiveness of disaster mitigation. Their role includes implementing mitigation programs, such as community service to clean water channels, building retaining walls, and monitoring surrounding conditions. Supervision carried out by the community ensures that mitigation measures are implemented correctly and effectively, while they also act as agents for disseminating information related to disaster hazards and preventive measures through counseling and education at the local level. The community also works together with various parties, including the government, tourism managers, and other community organizations, to ensure an integrated and comprehensive disaster response. The community at Curug Cilember shows active participation in various mitigation activities. They are involved in community service to clean water channels, build retaining walls, provide material assistance to victims, and conduct socialization of the importance of mitigation measures. Education about disaster risks, such as fixing clogged drains and evacuating to safe places during heavy rain, has been actively carried out by the community to raise awareness.

Community Participation and Utilization of Results Stage

Community participation in the utilization of disaster mitigation program results is a key element that is often overlooked, although it is very important to achieve development goals that improve the quality of life and equitable distribution of benefits. This stage involves evaluating community involvement to assess whether the disaster mitigation program has been in accordance with the plan and provided real benefits. In addition, the community has an important role in maintaining mitigation results so that the benefits of the program can be sustainable. Based on an interview with Mr. Purwo on April 21, 2024, the Megamendung community is active in reforestation activities as an effort to reduce the risk of landslides. With the help of the village head and the agricultural office, they plant perennial plants in landslide-prone areas to improve soil stability and prevent future disasters. The Disaster Resilient Village (Destana) program is a forum that facilitates community participation in disaster mitigation. According to Mr. Irwan, Destana

provides an opportunity for the community to contribute directly to disaster risk prevention and mitigation efforts. Mr. Andi added that the formation of Destana makes it easier for the community to apply for assistance to the local government and support reforestation and environmental maintenance programs. Mr. Uus also emphasized that Destana makes it easier to apply for assistance and increases community contributions to disaster mitigation through active roles as volunteers. Sustainable reforestation at Curug Cilember Megamendung is an important strategy to overcome ecosystem damage due to villa development and prevent landslides.

Community Participation and Evaluation Stage

The evaluation phase in disaster management is an important phase to assess the effectiveness of the mitigation program and identify obstacles or problems that arise during implementation. The evaluation aims to ensure that the interventions carried out are successful in reducing risks and providing real benefits to the community. Based on an interview with Mr. Irwan on April 21, 2024, the disaster mitigation evaluation was carried out in a structured manner by BPBD together with the Disaster Resilient Village (Destana) involving the community. The evaluation includes initial briefing and assessment at the end of the activity to assess the success of disaster mitigation. This process is carried out through deliberation with the community, where the evaluation results are conveyed transparently, allowing residents to provide feedback and constructive suggestions. Communication is an important element in the evaluation process. According to Mr. Leo, the evaluation results were conveyed through a deliberation forum involving the village, sub-district, and BPBD. This forum ensures that all parties have the same understanding of the results and obstacles to mitigation, and provides guidance for improvement.

Optimization strategies to overcome obstacles in landslide emergency response by involving managers, communities, and visitors to maintain compliance with ISO 45001 occupational safety and health standards.

Supporting Factors

Participation in disaster mitigation is a manifestation of individual behavior driven by various factors. At the Curug Cilember tourist location, Megamendung District, Bogor Regency, there are several main supporting factors that facilitate community involvement in landslide mitigation efforts.

Table 6. Supporting Factors for Community Participation

No.	Supporting Factors	
	Internal	External

1	The existence of a Disaster Resilient Village involves the Curug Cilember tourism management, BPBD, and the village and community.	The presence of government attention and support encourages the community to carry out mitigation
2	The readiness of the Disaster Resilient Village team and the Curug Cilember tourism management team who are always ready.	There is attention and support from visitors to encourage the Curug Cilember tourism management to carry out disaster mitigation.
3	The community's activeness and solidarity in carrying out community service, emergency response and disaster prevention	There is active involvement of local media in disseminating information regarding mitigation.
4	The community actively provides input during disaster mitigation socialization activities.	There is support from non-governmental organizations (NGOs)
5	Availability of logistical assistance provided by the Curug Cilember tourist management and local villages for victims disaster	Budget support from local government for the provision of logistics and equipment emergency response

(Source: Researcher Data Processing, 2024)

Inhibiting Factors

Table 7. Factors Inhibiting Community Participation

No	Inhibiting Factors	
	Internal	**External**
1	Lack of coordination between the community and tourism management	There is no funding to support the construction of retaining walls and cleaning of drainage.
2	Lack of intensive outreach to the community	Limited government support in providing adequate budget for training programs
3	Lack of communication to Publicrelated to the occurrence of disasters	There is no adequate early warning system to notify the public when a landslide occurs.
4	Lack of concern from community when there are other communities affected by landslides	Limited access to communication channels and fast and efficient information in emergency situations
5	Lack of sense of mutual cooperation in some community groups	Lack of support from non-governmental organizations

(Source: Researcher Data Processing, 2024)

Table 8 Efforts to Overcome Obstacles

No	Efforts to Overcome Obstacles	Concrete Implementation
1.	Effective Communication	Provide clear and accurate information about the benefits of the K3 system to tourism managers, the community, and visitors. All related parties understand the purpose and implementation of ISO 45001.
2.	Active Participation	Involving tourism managers, communities, visitors and implementing K3 systems. Providing opportunities for active participation
3.	Training right	Provide appropriate and effective training to tourism object managers, communities, and visitors about the K3 system.
4	Procedure Development	Makedevelopment of procedures and systems management that is easily accessible and understood by all related parties to comply with regulations related to K3.
5	AllocationResource	Providing appropriate priority on resource allocation based on OHS risks can improve the efficiency and effectiveness of ISO 45001.

(Source: Researcher Data Processing, 2024)

CONCLUSION

Based on research on landslide emergency response management at Curug Cilember Tourism, Megamendung, Bogor City, it was concluded that the implementation of emergency response management was carried out through cooperation between Curug Cilember managers and the Bogor Regency BPBD, involving the Destana community and the rapid response team for damage assessment and reporting. The stages of emergency response management include planning through coordination between managers, government, and the community, as well as participation in socialization, training, counseling; implementation involving collaboration in prevention, community service, construction of retaining walls; utilization of results through planting perennials for soil stabilization, and evaluation by strengthening communication, increasing community participation, and concern for disaster victims.

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