Digital Risk Communication in Hydrometeorological Disaster Mitigation in Gili Trawangan

Fajar Iqbal Mirza[1*], Lucky Mochamad Kharisma[2], Muhamad Hidayat[3] & Kadya Aulia Rizki[4]

[1234] LSPR Institute of Communication and Business

* email. fajar.im@lspr.edu

ABSTRACT

Gili Trawangan, a small island tourism destination in North Lombok, Indonesia, faces high vulnerability to hydrometeorological hazards, such as tidal flooding, coastal erosion, and storm surges. In this context, risk communication is critical in disaster mitigation, particularly with the increasing use of digital communication channels. This study examines how hydrometeorological disaster risk communication is implemented across three stages: anticipatory, crisis, and learning, using the Crisis and Emergency Risk Communication (CERC) framework. This research adopts a qualitative descriptive approach. Data was collected through in-depth interviews with key stakeholders, including local government officials (BPBD), civil society organizations, tourism business actors, community leaders, residents, and tourists. Empirical findings were analyzed using the six core principles of CERC (be first, be right, be credible, express empathy, promote action, and show respect) to assess the effectiveness of digital risk communication. The findings indicated that risk communication in Gili Trawangan remains fragmented and uneven across stages. Digital channels support rapid information dissemination during the anticipatory and crisis stages, but they remain limited in inclusivity and multilingual accessibility, particularly for tourists and temporary populations. In the learning stage, the absence of institutionalized digital evaluation mechanisms constrains continuous improvement. This study suggested integrated and inclusive digital risk communication to enhance disaster resilience and support sustainable tourism in small island destinations.

Keywords: CERC, digital communication, gili trawangan, hydrometeorological disasters, risk communication

277

INTRODUCTION

Gili Trawangan is the largest of the three Gili Islands (Gili Matra) in North Lombok, Indonesia, which represents a small-island tourism destination highly vulnerable to hydrometeorological hazards. Gili Trawangan attracts approximately one million tourists annually and is home to around 2.500 permanent residents and more than 750 tourism-related businesses (Partelow, 2021). These islands are susceptible to the impacts of climate change, including sea-level rise, increased coastal erosion, seawater intrusion, and flooding (Selvia & Iemaaniah, 2024). Over the past decade (2013-2023), Gili Trawangan has experienced significant coastal transformation, with 6.77 hectares of land lost due to erosion and only 0.4 hectares gained through accretion. Rapid tourism-driven development has further exacerbated these environmental vulnerabilities (Arben, 2024). Consequently, the island faces natural and anthropogenic pressures that render it highly vulnerable to climate-induced hydrometeorological disasters (Handayani et al., 2022).

Geographically, Indonesia, as an archipelagic country located at the convergence of major tectonic plates, is highly prone to various natural disasters. Law Number 24 of 2007 classifies disaster threats into three categories: geological, hydrometeorological, and anthropogenic (Febriani & Nurhayati, 2021). These geographical and geological conditions result in high seismic activity across most regions of Indonesia. The country is among the most disaster-prone nations globally, ranking 38th out of 181 countries in the 2021 World Risk Index. Data from the National Board for Disaster Management (known by its Bahasa acronym BNPB) indicate an increasing trend in disaster occurrences, with 5.402 events recorded in 2021, up from 4.642 in 2020. Globally, disaster events are projected to increase from approximately 350-500 occurrences per year during the 2000-2020 period to around 560 events annually by 2030. It is estimated that 97% of Indonesia's population is at risk of being affected by natural disasters, with 60% residing in areas of moderate to high vulnerability. Approximately 218.2 million people live in regions prone to earthquakes, tsunamis, volcanic eruptions, floods, and landslides (Hidayat, 2023).

In addressing these risks, Law No. 24 of 2007 stipulates that disaster management is generally structured into three phases: pre-disaster (mitigation and preparedness), emergency, and implemented in disaster management is disaster mitigation communication (Wempi et al., 2024). Within disaster mitigation communication, there is a specific concept known as risk communication, which more precisely explains how risks during disasters are communicated to reduce potential impacts and damages.

Risk communication is defined as a process of exchanging information, recommendations, and perspectives involving governments, experts, and the

public in responding to threats to survival, health, and socio-economic well-being. The implementation of risk communication is crucial in disaster contexts, as it aims to mitigate negative public sentiment while encouraging public compliance with necessary behavioral changes to effectively cope with disasters.

Fundamentally, risk communication promotes behavioral change within communities in response to potential risks. Effective risk communication is characterized by the ability to develop and convey emergency messages clearly. In risk communication situations, the availability of accurate information delivered on time across multiple levels could minimize social disruption as well as unintended or unforeseen economic impacts (Hidayat & Assegaf, 2025).

Disaster risk communication can be a bridge for various stakeholders. In addition, risk communication facilitates the flow of information and knowledge throughout the decision-making chain (Stewart, 2024). Risk communication is not merely the one-way dissemination of warnings and information; rather, it actively involves individuals and communities as participants in understanding potential disaster risks. Its objectives are to build awareness and encourage actions to mitigate risk. This process is inherently persuasive and structured, often involving continuous public education campaigns and scientific projections. Communication channels may range from traditional media (e.g., brochures and posters) to digital platforms and social media (Hidayat, 2023).

Risk communication consists of several stages during disaster. This aligns with Baxter's framework, as discussed by Dudi Iskandar, which conceptualizes management communication as comprising stages of planning (*perencanaan*), organizing (*pengorganisasian*), implementation (*implementasi*), and controlling (*pengendalian)* (Iskandar et al., 2022). Furthermore, from a public relations strategy perspective, three interrelated processes are identified: program planning, communication implementation, and evaluation (Nurhadi et al., 2022). Consistent with the communication theories and concepts outlined above, disaster risk communication also has three main stages: the anticipatory stage, in which hazards are identified; the communication stage, during which potential risks are shared with the public; and the learning stage, in which ongoing feedback and experiences contribute to the refinement of future communication strategies (Calman, 2002). However, in Indonesia, a number of challenges, such as digital divides, fragmented information systems, cultural and linguistic diversity, low public awareness, and infrastructural limitations, hinder effective risk communication (Hidayat, 2023).

In the context of risk communication in the digital era, one relevant theoretical framework is Crisis and Emergency Risk Communication (CERC). The CERC model was developed by the Centers for Disease Control and Prevention (CDC) to explain how risk and crisis communication should be conducted strategically before, during, and after disasters or emergencies

(Reynolds & Seeger, 2005). CERC suggests that effective risk communication must adhere to several core principles, the timeliness of information delivery (be first), message accuracy and correctness (be right), source credibility (be credible), empathy toward audiences (express empathy), encouragement of protective or corrective actions (promote action), and respect for the public (show respect) (Reynolds & Quinn Crouse, 2008).

Along with advances in information technology, CERC also promotes digital communication channels, such as social media, instant messaging applications, and official online platforms, as primary means for delivering real-time risk information. Digital channels can disseminate messages rapidly and reach broad audiences with two-way communication between authorities and the public (Houston et al., 2015; Reynolds & Seeger, 2005). In disaster contexts, the use of digital communication guided by CERC principles is crucial for reducing uncertainty and preventing panic.

The CERC framework is relevant for analyzing hydrometeorological disaster risk communication in tourism areas, such as Gili Trawangan, which are characterized by heterogeneous populations, including residents, business operators, and both domestic and international tourists. This diversity of audiences necessitates risk communication strategies that are adaptive to digital media. Therefore, the application of CERC principles serves as an important theoretical foundation for understanding how risk communication through digital channels is implemented across the stages of risk communication, the anticipatory stage, the communication stage, and the learning stage.

Accordingly, this study ensures that challenges and barriers are systematically identified with operational solutions and policy recommendations. Policies grounded in empirical research findings are expected to produce effective outcomes in addressing existing issues and reducing the impacts and losses resulting from unavoidable disasters.

To ensure the significance of the present study, the researchers review prior literature relevant to this research topic. Previous studies can be categorized into several main themes, including trends in hydrometeorological disasters and their driving factors, the role of communication in disaster management before, during, and after disasters, and risk communication practices in other regions.

First, prior studies examine the increasing trends in hydrometeorological disasters and their underlying causes. Research by Aeni and Anwar demonstrates that in West Java and the Capital Region of Jakarta, there has been an increase in hydrometeorological disasters driven by climate change and urbanization. Urbanization has led to significant changes in spatial planning and land-use conversion (Aeni & Khoirul Anwar, 2024). These findings are consistent with the study by Selvia and Iemaaniah, which analyzes land-use changes driven by tourism

infrastructure development in Gili Meno, Gili Trawangan, and Gili Air, resulting in ecological degradation and spatial planning conflicts (Selvia & Iemaaniah, 2024). In addition, Arben quantifies shoreline erosion over ten years to illustrate how tourism activities and weak coastal management contribute to physical vulnerability in Gili Trawangan (Arben, 2024).

Second, several studies examine the role of communication in disaster management before, during, and after disasters. Kotimah et al. investigate the use of digital media communication among shallot farmers as a means of information exchange that enables them to adapt to weather conditions. Through access to digital communication, farmers can adjust cropping patterns, crop diversification, planting periods, and irrigation systems. Weather-related information obtained from social media – sourced from relevant institutions, such as the Meteorology, Climatology, and Geophysics Agency (BMKG), the Department of Agriculture, and the Regional Disaster Management Agency (BPBD) – assists farmers in determining appropriate planting periods and minimizing the risk of crop failure (Khotimah et al., 2022). In addition, research by Rizal et al. demonstrates that in Pangandaran, community awareness of disaster mitigation literacy is relatively strong, shaped by lessons learned from past experiences that have fostered collective awareness. Communication is conducted through modern digital media, although it continues to face challenges related to disinformation and misinformation, as well as through formal education, which remains largely ad hoc. These communication channels have contributed to the development of a community with strong grassroots-based disaster literacy. However, this literacy has not been adequately integrated into formal Disaster Risk Reduction (DPR) systems. Effective risk communication, therefore, requires multi-channel, participatory, and culturally sensitive strategies (Rizal et al., 2025). Furthermore, environmental communication initiatives conducted by the Gili Eco Trust community through education and conservation programs have enhanced public awareness of the importance of disaster prevention as part of mitigation efforts (Paramitha et al., 2025).

Studies focusing on communication during disasters include research by Nurjanah et al., which examines the use of artificial intelligence in disaster communication between the government and the public through e-government platforms in North Lombok. The findings indicate that the successful implementation of e-government during the 2018 earthquake in North Lombok was driven by enabling factors such as the increasing level of information literacy among the local population and their familiarity with using internet-based media for everyday communication and information needs. However, inhibiting factors included limited telecommunication network coverage in North Lombok, particularly in blank-spot areas, due to the region's mountainous and valley-

dominated topography (Nurjanah et al., 2021). However, further optimization is required. Finally, research addressing post-disaster communication is represented by Partelow, who investigates the role of social capital in post-disaster recovery. The findings illustrate how social networks facilitate recovery processes but do not support preparedness communication (Partelow, 2021).

Third, prior studies have also examined risk communication practices in other regions. A study by Oktavia and Wardah, using a literature review of disaster-related research published between 2000 and 2020, demonstrates that communication is crucial in disaster management. However, most publications focus on analyzing and understanding observed phenomena (such as patterns of information dissemination, coordination mechanisms, and the use of social media) (Oktavia & Wardah, 2025). Furthermore, Hidayat and Achmad conducted a study on risk communication for hydrometeorological disaster mitigation in Bali, with the Crisis and Emergency Risk Communication (CERC) framework as the analytical lens. The findings indicate the presence of inclusive collaboration between traditional institutions and government authorities, as well as the effective implementation of key CERC principles in disaster risk communication practices in Bali (Hidayat & Assegaf, 2025).

Existing research on Gili Trwangan has largely focused on geological hazards, climate adaptation, or environmental change in general. Hydrometeorological threats, particularly those communication channels, remain underexplored, whereas they can effectively reduce damage and losses. Furthermore, employing a three-stage risk communication framework that explicitly examines each stage can generate more operational and comprehensive research outcomes. Most existing studies focus on only one stage of risk communication, theory failing to produce a holistic conclusion. The three stages are critically interrelated and essential for maximizing the effectiveness of risk communication in disaster-prone contexts. In addition, this study examines the implementation of digital communication across each stage of CERC-based risk communication, while also considering the role of existing traditional communication practices. Therefore, the research question guiding this study is how the implementation of the three stages of CERC-based risk communication addresses potential hydrometeorological disaster threats in Gili Trawangan through digital communication.

RESEARCH METHOD

This study employed a qualitative, descriptive approach. Data was collected through in-depth interviews with key stakeholders, including local governments (BPBD), civil society organizations (Muhammadiyah in disaster crisis management), tourism businesses, tourists, community leaders, and residents.

The interviews focused on hydrometeorological disaster risk communication practices conducted through traditional and digital communication channels. This study also used secondary data from scientific articles, journals, books, and online media.

This study adopted the CERC framework as the primary theoretical foundation for analysis because it is designed to explain communication during crises and emphasizes the role of digital media in conveying risk information quickly and accurately (Reynolds & Seeger, 2005). Operationally, the analysis was conducted based on the six main principles of CERC (Reynolds & Quinn Crouse, 2008). These principles are used as analytical indicators to assess how digital media, such as WhatsApp groups, the official BPBD website, and social media, are used at each stage of risk communication: the anticipatory stage, the communication (crisis) stage, and the learning stage.

Data analysis was conducted by linking empirical findings from interviews, field observations, and digital document reviews with CERC principles to identify practice patterns, communication effectiveness, and gaps between ongoing practices and recommended risk communication standards. To enhance the credibility of the findings, this study applied data triangulation through visual observations in Gili Trawangan, a review of digital media coverage, a review of local government documents, and comparisons with previous research and discussions with other researchers.

The ethical aspects of the research were enforced by ensuring that all interviewees received an explanation of the research objectives and provided informed consent before the interviews were conducted. The licensing and administrative processes with formal institutions were also implemented and documented. This study examined the risk communication process of hydrometeorological disasters through three stages of risk communication in Gili Trawangan. The research findings were expected to contribute to the development of effective risk communication strategies and the long-term sustainability of tourism in Gili Trawangan.

RESULT AND DISCUSSION

Risk communication on Gili Trawangan adopts a hybrid model that combines traditional and digital communication with three key stages: anticipatory, (crisis) communication, and learning. This structure shows the island's sociocultural complexity, which combines local wisdom and digital infrastructure. The research findings indicated that the information dissemination is uneven, particularly among international tourists, who often receive limited access to timely and multilingual information.

The integration of traditional and digital methods shows the understanding

that disaster communication must be inclusive and multidirectional (Calman, 2002; Stewart, 2024). In this section, the discussion refers to the three stages of communication: anticipation, communication, and education.

Table 1. Traditional and Digital Communication in All Stages of Risk Communication in Gili Trawangan

Stage	Traditional Communication	Digital Communication
Anticipation	- Direct staff briefing by hotel/villa managers - Verbal risk awareness messages at community meetings and religious sermons - Announcements at mosques (general preparedness). - Tree pruning and drainage cleaning by the community.	- WhatsApp group coordination between hotel owners, BPBD, and village heads. - BMKG weather forecasts shared via WhatsApp. - BPBD disaster website (underutilized by tourists).
Communication	- Sounding through mosques (TOA) for real-time warnings - Face-to-face instructions from the receptionist to guests upon check-in - Verbal announcements for evacuation to the hills - Use of local terminology (big wave)	- WhatsApp group alerts for extreme weather and earthquakes - BMKG Videotron at Bangsal Harbor (not yet available on this island). - Social media posts by NGOs.
Education	- Post-disaster reflections by community leaders and business owners - Joint training led by MDMC or BPBD (not routine) - Teachings shared at religious events - Verbal debriefings after the incident	- Sharing training videos and photos on WhatsApp - A future mobile app (early warning information + evacuation) – BPBD plan - Online coordination via WhatsApp for training planning

Source: Interview results

Anticipation Stage

The anticipation stage of disaster risk communication covers recognizing potential hazards, early dissemination of risk information, and public awareness before a disaster occurs. For Gili Trawangan, this stage is shaped by the island's

physical geography and socioeconomic structure. The island's low elevation, reliance on tourism, and exposed coastline make it highly vulnerable to hydrometeorological threats, including sea level rise, coastal erosion, extreme weather, and freshwater scarcity (M. Zaldi, interview on April 23, 2025).

Based on assessment by BPBD supported by field observations, Gili Trawangan is exposed to at least 10 of the 11 disaster risks common to the region, excluding volcanic eruptions. Hydrometeorological threats are classified into wet (e.g., tidal flooding, extreme rainfall) and dry (e.g., water scarcity, drought), both of which are becoming more frequent. Coastal erosion of 6.77 hectares over the past decade, with only 0.4 hectares of accretion, shows the increasing environmental pressure (M. Zaldi, interview on April 23, 2025).

Agus Heri Purnomo, a member of the BPBD of North Lombok Regency who is responsible for disaster prevention and alertness, stated that he is currently developing a disaster information system website accessible at https://sikbpbd.lombokutarakab.go.id. This website is being developed to mitigate disaster risks in North Lombok Regency, including Gili Trawangan Island (Agus, interview on May 15, 2025).

In this early stage, disaster alertness practices are distributed across the individual, community, and institutional levels. Local community leaders, such as Haji Malik in Gili Eco Trust, recognize the vulnerability of these environmental disaster risks. His community initiative focuses on building climate resilience through education and ecosystem restoration. "We are not only at risk from the sea, but also from what we build too close to it," he explained, citing the loss of native vegetation and unregulated development as contributing factors (Malik, interview on April 24, 2025).

At the institutional level, programs such as Destana (Disaster Resilient Village) have been implemented in Gili Indah, which covers three islands: Gili Trawangan, Gili Air, and Gili Meno. The Gili Indah village government explained that these programs include mapping evacuation routes, establishing safe zones (mosques, hills), and training community groups such as Karang Taruna (Youth Organization) and fishermen (Village Government, Personal Communication, April 23, 2025). However, coverage is uneven. The village government acknowledges that limited staffing and resources hinder outreach to the wide community, particularly tourists and temporary workers.

In the tourism sector, some businesses have adopted internal alertness protocols. For example, Blue Marlin Dive Center has developed evacuation plans for its staff and guests. However, as other businesses have noted, the lack of standard operating procedures across the tourism industry leads to varying practices. More importantly, international tourists remain the least prepared demographic. Dutch tourists interviewed in this study reported receiving no risk-

related information before or during their stay on Gili Trawangan. In their home countries, disaster education is virtually non-existent due to their low exposure to natural disasters. Consequently, tourists often arrive unaware or unprepared (Fabriana & Eirem, interview on April 24, 2025). These findings align with global literature that suggests the challenges in educating international tourists (UNDRR, 2022). The lack of pre-arrival communication materials and the failure to provide multilingual educational resources upon arrival indicate a gap in the system in anticipatory risk communication.

Meanwhile, the Head of the BPBD explained that digital tools play a role. WhatsApp groups are commonly used for coordination between tourism stakeholders, the BPBD, and village leaders. Through this platform, weather forecasts and disaster warnings from the BMKG are disseminated, enabling business owners to anticipate and prepare for extreme conditions. These digital groups serve as an effective early warning system for local stakeholders (M. Zaldi, interview on April 23, 2025).

Despite these efforts, anticipatory communication on Gili Trawangan is fragmented. One major challenge is the lack of standardized, multilingual materials accessible to both locals and tourists. Research in Bali and Phuket has shown that alertness brochures, hotel information boards, and portside announcements significantly increase tourists' awareness and willingness to comply with evacuation measures (Becken & Hughey, 2013). Without similar initiatives, Gili Trawangan risks leaving its largest economic stakeholder, international tourists, uninformed during a critical situation.

Another limitation is in the integration between community-based initiatives and institutional frameworks. The Destana program is commendable, but its impact is diminished if it is not connected to broader district- or provincial-level planning. Paton argues that alertness requires systematic support, including policy enforcement and resource allocation. This gap is evident when comparing Gili Trawangan with Japan, where hazard education is mainstreamed through schools, tourism offices, and local government systems (Paton, 2019).

Furthermore, anticipatory communication would benefit from the expanded use of digital innovations. Mobile apps, QR code signage, and social media channels can provide multilingual updates to migrating populations. Evidence from the Maldives suggests that when a mobile-based warning system was piloted across islands, tourists reported higher levels of trust and preparedness (Shakeela & Becken, 2015). It suggests that technology, when integrated with traditional community networks, can strengthen anticipatory resilience on small islands, such as Gili Trawangan.

When analyzed using the Crisis and Emergency Risk Communication (CERC) framework, risk communication practices in the anticipatory phase on

Gili Trawangan demonstrate the initial implementation of six key principles, although they are not yet evenly distributed. The be-first principle is evident in the rapid dissemination of weather forecasts and potential hazards from the BMKG (Meteorology, Climatology, and Geophysics Agency) through WhatsApp groups between the Regional Disaster Management Agency (BPBD), village heads, and tourism businesses, in line with CERC's emphasis on the speed of pre-crisis information (Reynolds & Seeger, 2005). From the be-right perspective, information accuracy is relatively well maintained because it originates from official institutions, but the lack of a standardized digital message format often results in information being simplified when conveyed verbally or via text message (Reynolds & Quinn Crouse, 2008).

The principle "be credible" at this stage relies more on community and religious leaders with high social legitimacy than on digital channels, such as the BPBD website. It confirms that the credibility of risk communication on Gili Trawangan is more relational than technological, as suggested in the CERC framework (Reynolds & Seeger, 2005). The principles "express empathy" and "show respect" are represented in the delivery of risk awareness in community meetings and religious sermons using simple local language, which is effective for local communities but not yet inclusive for international tourists (UNDRR, 2022). Meanwhile, the principle of "promoting action" is beginning to be realized through community-based mitigation measures, such as drain cleaning and tree pruning, although it has not been consistently linked to systematic digital messaging.

This dual approach fosters more resilient communities, ultimately improving disaster preparedness and response capabilities across diverse populations. Strengthening collaboration between local leaders and digital platforms can increase the inclusiveness and effectiveness of risk communication efforts. Building synergy between traditional and digital approaches to risk communication can strengthen community capacity to cope with disasters and raise awareness of the importance of mitigation.

Integrating local wisdom with modern communication strategies can significantly enhance disaster preparedness and community resilience, ensuring that all members, including tourists, are well informed and actively engaged. By combining traditional knowledge with digital platforms and early warning systems, communities can respond more effectively to potential hazards. This inclusive and comprehensive approach strengthens trust, improves coordination, and fosters shared responsibility. Moreover, enhancing collaboration between local leaders and government agencies is crucial for building reliable communication networks and improving overall disaster mitigation efforts.

Table 2. CERC Analysis of Anticipation Stage

CERC Principle	Measures	Main Channel	Analysis
Be First	Dissemination of weather forecasts and potential hazards from BMKG	WhatsApp BPBD–village head–business actor	Fast within the core stakeholder sphere, less accessible to tourists and temporary workers
Be Right	Information sourced from official institutions	WhatsApp, verbal communication	Accurate but not standardized, so at risk of being simplified or distorted
Be Credible	Community leaders and religious leaders are the main references	Community meetings, sermons	Credibility is relational, stronger than institutional digital channels
Express Empathy	Risk education with a local language and cultural approach	Sermons, community forums	Effective for locals, less inclusive for multilingual audiences
Promote Action	Drainage cleaning and tree pruning	Community actions	Mitigation measures exist, but they have not been linked to consistent digital messaging
Show Respect	Approach based on local norms and wisdom	Face-to-face communication	Sensitive to local culture but not considering the tourists' needs

Source: Data analysis results

Communication Stage

The next is the communication stage (emergency dissemination and coordination), which covers the real-time exchange of risk information during disasters. The goal is to enable informed protective action by all stakeholders (Calman, 2002). In Gili Trawangan, this process is shaped by the interaction of traditional and digital communication systems.

A community leader explained that for the local community, communication relies heavily on mosque speakers (TOAs) and community WhatsApp groups. During the 2018 earthquake, these systems proved vital, warning residents to evacuate to higher ground (Malik, interview on April 24, 2025). However, for non-Muslim residents, migrant workers, and tourists, these channels are ineffective due to language barriers and less engagement in messaging networks.

A representative from the BPBD explained that the tourism sector is working to bridge this gap, albeit inconsistently. Hotels often provide verbal instructions at check-in, but as noted by travelers and business operators, few accommodations provide printed evacuation plans or visual signs. Where signs exist, they are often bilingual, but their placement is inconsistent, and vandalism has caused some signs to be illegible (M. Zaldi, interview on April 23, 2025).

A representative from the Regional BPBD of North Lombok also explained that BPBD and BMKG had installed a Videotron at Bangsal Harbor that displays live ocean and weather data. However, this facility is useful only for ship operators and certain residents (M. Zaldi, interview on April 23, 2025).

A representative from the MDMC stated that the choice of language and communication method is crucial. The MDMC noted that many residents struggle with technical terms, such as *tsunami*. Instead, phrases like 'big waves' are easier to understand. Similarly, religious leaders have begun integrating disaster education into sermons by promoting disaster alertness as a religious obligation (S. Mohammed, interview on April 24, 2025).

However, other challenges remain. Some businesses are reluctant to install risk signs for fear of alarming visitors. Ironically, two tourists shared that visible safety information would actually make them feel safer and respected by local authorities (interview, April 24, 2025). Therefore, there is a gap between perception and practice (Toya & Skidmore, 2007).

MDMC representatives explained that the BPBD relies on WhatsApp coordination, involving district leaders, NGOs, and even military officials. This channel has been praised for its speed but criticized for its exclusivity. Many small businesses, workers, and informal groups are not represented on these channels, which causes delays or blind spots in information dissemination (S. Mohammed, interview on April 24, 2025).

When analyzed through the CERC framework, the six main principles of risk communication practices during the crisis on Gili Trawangan have not been implemented equally. The principle of 'be first' is relatively fulfilled through the use of mosque speakers and community WhatsApp groups that allow for rapid information dissemination during extreme weather and earthquakes (Reynolds & Seeger, 2005). However, from the 'be right' perspective, the messages conveyed tend to be general and are not always accompanied by detailed and visual action guides with multiple languages, which causes confusion among international tourists (Reynolds & Quinn Crouse, 2008).

The principle "be credible" in crisis relies more on local figures with high social legitimacy than on institutional digital channels. The principle of expressing empathy is evident in the use of local terms, such as 'big waves,' which are more easily understood by local communities but potentially ambiguous for non-local audiences (UNDRR, 2022). Meanwhile, the principle of promoting action is implemented through verbal evacuation instructions to the hills but has not been reinforced with digital media support such as online evacuation maps or quickly accessible infographics, as recommended in CERC (Houston et al., 2015). The principle "show respect" has not been fulfilled 100 percent due to a tendency to withhold risk information to tourists to avoid panic, which has the potential to

weaken public safety and long-term trust.

This situation suggests education as a subsequent action in risk communication. The lack of real-time multilingual warnings and the absence of mobile-friendly platforms hinder rapid and inclusive communication during emergencies. To address this, the BPBD and MDMC have proposed a mobile app, printed infographics, and regular drills, yet they are in planning or pilot stages.

Table 3. CERC Analysis of Communication Stage

CERC Principles	Measures	Main Channel	Analysis
Be First	Emergency warning during earthquake/extreme weather	TOA, WhatsApp	Fast and effective for local community, limited for non-Muslims and tourists.
Be Right	Evacuation messages are general	TOA, verbal instructions	Lack of detail, minimal visual and multilingual guidance
Be Credible	Trust in local figures	Religious figures, community figures	High credibility socially, weak institutionally-digitally.
Express Empathy	Use of the term "big waves"	Verbal communication	Easy for locals to understand, ambiguous for foreign tourists.
Promote Action	Evacuation instructions to the hills	TOA, hotel instruction	There is a push for action, but without the support of maps or digital media.
Show Respect	Risk information is withheld to avoid panic	Tourism sector practices	Ignores tourists' right to information and potentially undermines trust.

Source: Data analysis result

In Gili Trawangan, intensive, repeated, and multilingual information is crucial due to the diversity of the community, including international visitors with varying levels of technological access and language proficiency. The lack of multilingual warnings is problematic. Disaster response studies in Japan and the Maldives show that providing real-time information in English and other common languages among tourists significantly increases compliance with evacuation orders and reduces panic among foreign residents (Shakeela & Becken, 2015).

Another challenge is misinformation. During a crisis, rumors spread rapidly, especially on social media, which can undermine official messages. Proactive digital engagement is required to counter misinformation and maintain credibility (Houston et al., 2015). For Gili Trawangan, developing an official and verified social media presence jointly managed by the BPBD and the local tourism association can expand reach and counter the rumor.

Finally, alertness exercises that integrate tourists, businesses, and residents are crucial to ensure communication protocols are understood and trusted.

Evidence from the community exercises in the Philippines shows that regular multilingual simulations strengthen memory retention of protective measures and build trust among stakeholders. Without such inclusive practices, even well-designed systems risk failure at critical moments.

Education Stage

The education stage consists of feedback, adaptation, and institutionalization. It evaluates the effectiveness of communication strategies and integrates those lessons into future planning. In Gili Trawangan, this stage is shaped by the experience of the 2018 earthquake. The Gili Indah Village Government explained that post-disaster reflections support the installation of signage. The Destana program includes simulation exercises, evacuation standard operating procedures (SOPs), and food and sanitation planning for safe zones (Local Government, interview, 2025). However, the frequency and consistency of these efforts vary.

The BPBD explained that there is no structured post-disaster evaluation system. Feedback is largely anecdotal, and there is no survey mechanism to measure whether residents and tourists understood or acted on the alerts communicated. BPBD recognizes this shortcoming and is working to establish a monitoring and evaluation framework as part of its regional disaster literacy initiative (Agus, interview, May 15, 2025).

The education stage of risk communication on Gili Trawangan shows that the implementation of the six main principles remains partial. The principles of "be first" and "be right" have not been optimally realized due to the absence of a rapid post-disaster evaluation mechanism, such as digital surveys or systematic documentation of public and tourist understanding (Reynolds & Seeger, 2005). From the perspective of "be credible," the post-disaster learning process relies more on trusted community actors, but has not been institutionalized within the framework of official local government policies and procedures.

The principles of expressing empathy and showing respect are reflected in reflections conducted in religious and community forums, which have proven effective in building social acceptance of disaster messages. However, this learning process has not completely involved tourists and business actors, so the perspective of the temporary population remains neglected. The principle of promoting action in the learning stage is evident in the implementation of disaster simulations and exercises, although they are not yet conducted routinely, multilingually, and based on digital scenarios. Repetitive and inclusive exercises have been shown to strengthen preparedness and memory retention of protective actions (Shakeela & Becken, 2015). These findings suggest that without institutionalizing CERC learning through digital platforms, risk communication on Gili Trawangan risks stagnation and difficulty in developing sustainably.

Table 4 CERC Analysis of Education Stage

CERC Principle	Measures	Main Channel	Analysis
Be First	Post-disaster reflection is informal	Discussion among communities	There is no rapid and documented evaluation mechanism
Be Right	Experiential learning	Community forum	Minimum structured data for systematic improvement
Be Credible	Education by local actors	Society Vigures, LSM	Socially credible, not yet institutionalized in policy
Express Empathy	Disaster education in religious forums	Sermons, community meetings	Culturally effective but not engaging with tourists
Promote Action	Disaster simulation and training	Community training	Not routine, not multilingual, and not digital-based.
Show Respect	Recognition of local experiences	Social reflection	Perspectives of the temporary population (tourists) are neglected.

Source : Data Analysis Result

According to a business owner, networks have been established to provide learning, such as "Bajang Tangguh Bencana." They share evacuation tips, pool resources, and conduct joint exercises. However, without formal recognition or integration into district planning, their efforts risk isolation and unsustainability (Zohri, interview on April 24, 2025).

An MDMC representative explained that the religious and cultural sectors have been actively involved in adaptive learning. Sermons, prayer meetings, and interfaith forums now incorporate disaster education. This approach has proven more effective than the purely technical briefings in changing public attitudes (S. Mohammed, interview on April 24, 2025). As mentioned, the view that disaster warnings "bring disaster" is gradually replaced by the understanding that alertness protects.

However, deep structural issues exist. Some shelters remain damaged from previous disasters. Siren systems are unavailable. Transportation for mass evacuations is unreliable. These physical gaps directly hinder improvement by learning. Without investment in infrastructure, behavioral adaptation alone is not enough.

Local community leaders further explained that environmental sustainability is a priority. The local residents have raised concerns about the rapid conversion of coastal areas to permanent structures, which accelerates erosion and restricts natural drainage (Malik, interview on April 24, 2025). Despite these warnings, policy enforcement remains weak, and development continues unabated.

To institutionalize education, the following actions are recommended: First,

regular simulations should be conducted bilingually, involving tourists, staff, and residents. Conducting scheduled bilingual disaster drills involving tourists, hospitality staff, and local communities can bridge gaps in understanding and strengthen collective memory. These simulations should include step-by-step evacuation guides and role-playing to ensure clarity across language and cultural barriers. Involving diverse stakeholders in simulation scenarios also improves practical alertness.

Second, facilitate feedback, such as post-event surveys and social media polls, to evaluate communication outcomes. Establishing post-event digital surveys, hotel suggestion boxes, and social media polls can inspire the way communication is received and interpreted. This can inform risk messaging and content clarity. Furthermore, it can encourage feedback from the local community and international visitors to ensure a comprehensive assessment of the communication process.

Third, establish planning forums involving hotels, government, NGOs, and religious leaders. Developing a formal platform for coordination, such as a quarterly forum or emergency planning meeting, supports shared understanding among hotel managers, local government, religious leaders, NGOs, and community groups. These forums should be designed to align resources, develop joint standard SOPs, and simulate decision-making during hypothetical disasters.

Fourth, digital expansion, including mobile alerts and QR code-linked signage. Efforts should be made to develop multilingual mobile alert systems. Additionally, QR code-linked signage at key tourist hotspots (e.g., beaches, dive centers, ports) could direct users to interactive maps, emergency contacts, and instructional videos, which allow access to critical information regardless of language or literacy level.

Fifth, integrate traditional and digital communications. The Gili Trawangan experience demonstrates that disaster risk communication is most effective when traditional and digital tools are integrated. Traditional methods build trust and social cohesion, and digital platforms enable speed, scale, and coordination. This hybrid approach can reach diverse audiences. Studies show that communities are more likely to respond to trusted local voices, such as religious leaders or village heads, but it must be complemented by real-time alerts via digital platforms to be effective (Stewart, 2024).

Evidence from other small islands supports this argument. In Samoa, for example, radio announcements combined with SMS alerts and messaging via churches achieved a significant reach during cyclone warnings (Mercer et al., 2010). Similarly, research in Hawaii showed that QR-coded evacuation signs linked to multilingual hazard maps increased tourist awareness and alertness (Wood & Schmidtlein, 2013). These cases suggest that hybrid systems are not

optional but necessary in multi-stakeholder and multilingual contexts.

Finally, risk communication in Gili Trawangan faces technical, socio-cultural, and institutional challenges. Building resilience requires embedding communication practices into daily routines. By integrating traditional and digital channels, Gili Trawangan can move closer to becoming a model of small island disaster resilience.

CONCLUSION

This study shows that hydrometeorological disaster risk communication in Gili Trawangan proceeds through three main stages: anticipation, (crisis) communication, and education. The CERC analysis shows that the six main principles of crisis communication are present in practice, but their implementation is partial, with less consistent integration in all stages. In the anticipation stage, risk communication is relatively effective among local communities through social networks, but it is not yet inclusive of tourists and temporary populations. The (crisis) communication stage demonstrated that information dissemination is rapid, but message clarity, visual action guides, and multilingual delivery are limited. Meanwhile, in the education stage, post-disaster reflections and community initiatives are conducted, but they are not yet supported by digital evaluation and documentation.

The findings confirm that the challenge to risk communication in Gili Trawangan is not in the availability of communication channels but in integration, message standardization, and audience inclusivity. This research contributes by demonstrating how CERC can be operationalized to analyze digital risk communication in tourism destinations located on small islands.

REFERENCES

Aeni, P. & Anwar, M.K. (2024). Hydrometeorological Disaster: Challenges and Mitigation in Indonesia. *Jurnal Indonesia Sosial Teknologi*, *5*(01), 318–330. https://doi.org/10.59141/jist.v5i01.888

Arben, V. (2024). Analysis of coastline changes on Gili Trawangan over the last ten years, 2013 to 2023. *Russian Journal of Agricultural and Socio-Economic Sciences.*

Becken, S., & Hughey, K. F. D. (2013). Linking tourism into emergency management structures to enhance disaster risk reduction. *Tourism Management*, *36*, 77–85. https://doi.org/10.1016/j.tourman.2012.11.006

Calman, K.C. (2002). Communication of Risk: Choice, Consent, and Trust. *The Lancet*, 360 (9327), 166–168. Doi:10.1016/s0140-6736(02)09421-7.

Centers for Disease Control and Prevention. (2018). *Crisis and emergency risk communication (CERC): Introduction.* U.S. Department of Health and Human

Services. https://emergency.cdc.gov/cerc/

Febriani, D. & Nurhayati, S. R. (2021). Description of the dynamics of the resilience of people victims of the 2018 North Lombok earthquake. *IOP Conference Series: Earth and Environmental Science*, *884*(1). https://doi.org/10.1088/1755-1315/884/1/012040

Handayani, K., Sulistyadi, Y., & Hasibuan, B. (2022). Optimalisasi implementasi prinsip-prinsip ekowisata berbasis masyarakat di Pulau Wangi-Wangi. *Seminar Nasional Pariwisata dan Kewirausahaan (SNPK)*, *1*.

Hidayat, M. (2023). *Komunikasi Bencana Perspektif Pembangunan Berkelanjutan* (R. Fauzan, Ed.; Vol. 1). Rajawali Press. www.rajagrafindo.co.id

Hidayat, M. & Ananto Akbar. (2024). Community-based disaster communication in the emergency response phase of the eruption of Mount Lewotobi, East Flores. Jurnal Cahaya Mandalika ISSN 2721-4796 (online), 5(2), 713-719. https://doi.org/10.36312/jcm.v5i2.3054

Hidayat, M. & Assegaf, A. H. (2025). Komunikasi risiko mitigasi bencana hidrometeorologi dampak kerusakan lingkungan. *Jurnal Komunikatio,* 11(1), 36-46. https://doi.org/10.30997/jk.v11i1.16519

Houston, J. B., Hawthorne, J., Perreault, M. F., Park, E. H., Goldstein Hode, M., Halliwell, M. R., Turner Mcgowen, S. E., Davis, R., Vaid, S., Mcelderry, J. A., & Griffith, S. A. (2015). Social media and disasters: A functional framework for social media use in disaster planning, response, and research. *Disasters*, *39*(1), 1–22. https://doi.org/10.1111/disa.12092

Iskandar, D., Suryawati, I., & Liliyana, L. (2022). Communication Management of the Religious Harmony Forum of DKI Jakarta in Overcoming Intolerance and Radicalism. *Communicatus: Jurnal Ilmu Komunikasi*, *6*(1), 73–96. https://doi.org/10.15575/cjik.v6i1.16659

Johanis Rumambi, F., & Novita Sari, D. (2023). Is the Tourism Business Ready to Face the Threat of Tsunami Disaster? (Case Study of Coastal Area of North Lombok Regency).

Khotimah, N., Sumunar, D. R. S., Purwantara, S., Prabintoro, N. S., Ibrahim, M. H., & Nayan, N. (2022). The role of social media as a communication facility for hydrometeorological disasters in shallot farming activities. *Informasi*, *52*(1), 47–62. https://doi.org/10.21831/informasi.v52i1.50115

Mercer, J., Kelman, I., Taranis, L., & Suchet-Pearson, S. (2010). *Framework for integrating indigenous and scientific knowledge for disaster risk reduction*. https://doi.org/10.1111/j.03613666.2009.01126.x

Nurhadi, Z. F., Mujianto, H., & Rusliani, D. N. (2022). Public Relations Strategy of Health Service in Socializing Covid-19 Vaccination Program. *Communicatus: Jurnal Ilmu Komunikasi*, *6*(1), 51–72. https://doi.org/10.15575/cjik.v6i1.16406

Nurjanah, A., Mutiarin, D., & Kasiwi, A. N. (2021). The Use of Artificial Intelligent in Disaster Communication between Government and Society through E-Government in North Lombok. *IOP Conference Series: Earth and Environmental Science*, *717*(1). https://doi.org/10.1088/1755-1315/717/1/012038

Oktavia, Y., & Wardah, N. K. (2025). Literature studies on natural disasters and communication in Indonesia. *E3S Web of Conferences*, *604*. https://doi.org/10.1051/e3sconf/202560402008

Paramitha, K. D. P., Hidayat, M., Kharisma, L. M., & Dwijayanti, A. A. I. P. (2025). Environmental Communication Strategies in Educational Tourism at Gili Trawangan in Response to Climate Change. *JCommsci - Journal Of Media and Communication Science*, *8*(2), 82–89. https://doi.org/10.29303/jcommsci.v8i2.520

Partelow, S. (2021). Social capital and community disaster resilience: post-earthquake tourism recovery on Gili Trawangan, Indonesia. *Sustainability Science*, *16*(1), 203–220. https://doi.org/10.1007/s11625-020-00854-2

Paton, D. (2019). Disaster risk reduction: Psychological perspectives on preparedness. *Australian Journal of Psychology*, *71*(4), 327–341. https://doi.org/10.1111/ajpy.12237

Reynolds, B., & Quinn Crouse, S. (2008). Effective communication during an influenza pandemic: the value of using a crisis and emergency risk communication framework. In *Health promotion practice* (Vol. 9, Number 4 Suppl). https://doi.org/10.1177/1524839908325267

Reynolds, B., & Seeger, M. W. (2005). Crisis and emergency risk communication as an integrative model. *Journal of Health Communication*, *10*(1), 43–55. https://doi.org/10.1080/10810730590904571

Rizal, E., Winoto, Y., Sugito, T., Nugroho, C., & Septian, F. I. (2025). Disaster communication in the digital age: a community-based case study of media, education, and local knowledge in Pangandaran, Indonesia. *Frontiers in Communication*, *10*. https://doi.org/10.3389/fcomm.2025.1632436

Selvia, S. I., & Iemaaniah, Z. M. (2024). The dynamic and challenges of land use change on small island (case study of Gili Meno, Trawangan and Air). *Agrimansion*, *25*(1).

Shakeela, A., & Becken, S. (2015). Understanding tourism leaders' perceptions of risks from climate change: an assessment of policy-making processes in the Maldives using the social amplification of risk framework (SARF). *Journal of Sustainable Tourism*, *23*(1), 65–84. https://doi.org/10.1080/09669582.2014.918135

Stewart, I. S. (2024). Advancing disaster risk communications. In *Earth-Science Reviews* (Vol. 249). Elsevier B.V.

https://doi.org/10.1016/j.earscirev.2024.104677

Toya, H., & Skidmore, M. (2007). Economic development and the impacts of natural disasters. *Economics Letters*, *94*(1), 20–25. https://doi.org/10.1016/j.econlet.2006.06.020

Ramdani, T., Rosyadi, M.A., Evendi, A. & Rani, A.P. (2020). Persepsi Masyarakat Dusun Gili Trawangan Terhadap Penyebab Terjadinya Bencana Gempa Bumi. Resiprokal, 2.

United Nations Office for Disaster Risk Reduction. (2022). Global assessment report on disaster risk reduction 2022: Our world at risk: Transforming governance for a resilient future. United Nations Office for Disaster Risk Reduction (UNDRR). Geneva. Available at https://www.undrr.org/gar/gar2022-our-world-risk-gar

Wempi, J. A., Hidayat, M., & Akbar, A. (2024). Spiritual Communication for Disaster Mitigation in the Gunung Padang Area - West Java. *Jurnal Komunikasi Ikatan Sarjana Komunikasi Indonesia*, *9*(2), 327–333. https://doi.org/10.25008/jkiski.v9i2.1109

Wood, N. J., & Schmidtlein, M. C. (2013). Community variations in population exposure to near-field tsunami hazards as a function of pedestrian travel time to safety. *Natural Hazards*, *65*(3), 1603–1628. https://doi.org/10.1007/s11069-012-0434-8