Jurnal Komunikasi Indonesia

Volume 12 | Number 1 Article 2

3-1-2023

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Volume XII
Issue 1
Maret 2023
ISSN 2301-9816

JURNAL
KOMUNIKASI
INDONESIA

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Article Information
Received (1/30/2023);
Received in revised form (09/02/2023);
Accepted (05/03/2023);
Available online (21/04/2023)

Keywords/*Kata Kunci*
crisis communication; disaster regulations, soft systems methodology based multi-method; social network analysis; textual network analysis

Abstract/*Abstrak*

This study aims to discuss disaster crisis communication policies for non tectonic tsunami in Indonesia. The case study was selected from the Sunda Strait tsunami that occurred in December 2018 and claimed more than 400 lives. The disaster is unusual since it is included as a non-tectonic tsunami and unable to be detected by the current tsunami early warning system. This study was conducted at the macro level, namely an analysis of disaster communication policies, specifically Law No. 24/2007 on Disaster Management. The data were collected through big data analysis of the word disaster, textual network analysis of disaster laws, and in-depth interviews with six national disaster stakeholders. The discussion applied Soft Systems Methodology (SSM) based Multi-Method with a combination of Social Network Analysis (SNA) and Textual Network Analysis (TNA) in the stage 2 of SSM, namely compiling a Rich Picture. The application of SSM based Multi-Method has provided a new methodological variant of SSM. The findings of this study contribute to: First, proving the lack of coordination between disaster regulations stipulating several disaster agencies, leading to the faulty operation of the non-tectonic tsunami early warning system. Second, providing recommendations to disaster policy makers to amend Law No. 24/2007. Third, suggesting the transformation of an integrated crisis communication system among national disaster agencies. Fourth, confirming the involvement of Indonesian National Armed Forces (TNI) and Indonesian National Police (Polri) in the process of disseminating information and communication, considering that these two institutions have networks that reach the lowest levels of society. Fifth, proposing the importance of increasing disaster education to disaster stakeholders at the central to regional levels as well as the community on a massive basis, particularly in areas prone to potential disasters.

Introduction

Studies on crisis communication strategies have been developed and examined in both academic and field studies over the past decades (Coombs & Holladay, 2009). However, studies on policies regarding disaster crisis communication in digital media at the macro level remains significantly limited. The available studies are dominated by crisis communication studies on social media at the organizational level (Alexander, 2014; Austin & Jin, 2017; Houston et al., 2015; Jin & Liu, 2010; Liu et al., 2011, 2012, 2015, 2016), the behavior of spreading rumors or hoaxes during disasters at the individual or public level (Austin et al., 2012; Kim et al., 2017; Liu et al., 2011; Zhao et al., 2016), and the role of media in crisis communication (Austin & Jin, 2017; Ford, 2013; Gao et al., 2010; Goolsby, 2010; Graham et al., 2015; Hagen et al., 2018; Hardjosoekarto et al., 2013; Manso & Manso, 2013; Rasmussen & Ihlen, 2017; Song-Qi Lim et al., 2017; Tække, 2017).

Observing the constant development of digital media from time to time, the authors assume that studies on crisis communication in digital media at the policy level should also be developed, since communication gaps always prevail during a disaster, particularly for the affected people (Kim et al., 2017). As the consequence, rumors or hoaxes are easily spread in digital media, causing disinformation for the public (Zhao et al., 2016).

It is particularly common in Indonesia as one of the 35 most disaster-prone countries in the world. Disasters fall into the category of public crises (Kippenberger, 1999). A public crisis is defined as an emergency situation in which national security, public security, public order, and the lives and property of citizens are at risk or imperiled, causing large death toll, property damage, and social consequences, which need to be addressed immediately by the public. Disaster as a public crisis requires effective crisis communication to the public, which should be regulated in appropriate legal regulations because it relates to the lives of many people. Studies on disaster communication policies are scarce and centralized at the level of cases in certain organizations or social media (Akhyar & Pratiwi, 2019; Mahaswari, 2017; Prastya, 2011). Up to this present day, Indonesia still applies Law No. 24/2007 which was ratified 15 years ago. In fact, the number and types of disasters in Indonesia continue to increase significantly each year, as shown in the following data from the National Agency for Disaster Management (BNPB). Referring to the latest data, 5402 disaster events have occurred in Indonesia until the end of 2021.

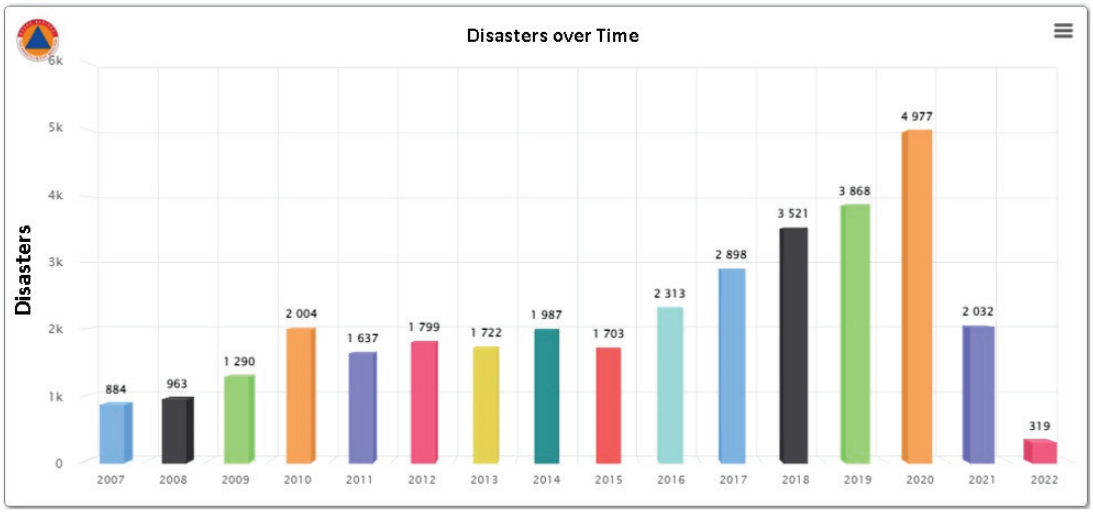


Figure 1. Disaster statistics in Indonesia in 2007-2020 (Source: https://dibi.bnpb.go.id/)

Law No. 24/2007 generates several derivative regulations. However, as their umbrella is not up-to-date, they tend to be ineffective due to their sectoral, casuistic, and incomprehensive nature. This study aims to explain the need for total policy amendments in disaster management in Indonesia, including in its crisis communication system.

Reflecting on numerous past disaster events, the authors employed the perspective of evidence-based crisis management theory (Coombs & Holladay, 2010) that bases all decisions and policies on accurate data and information. Coombs emphasizes the importance of situational awareness of each disaster stakeholder during a disaster to establish a crisis-sensing network among stakeholders, thus enhancing crisis knowledge management.

The issue of disaster crisis communication, specifically in non-tectonic tsunami management policies, is the main appeal and also the limitations of this study. The focus of this study is around disaster management policies. The authors suspect gaps between the knowledge of policy makers and the reality of non-tectonic tsunamis. In reality, an analysis of tsunami waveforms reveals that the December 2018 volcanic tsunami has a short period and duration, with the dominant period and duration of 6.6–7.4 minutes and 6–8.5 hours, respectively. These figures are significantly more short-lived than typical tectonic tsunamis (Muhari et al., 2019). It indicates two big holes in the tsunami disaster policy regulations that have not been resolved, namely the position of non-tectonic tsunamis in the policy and the lack of immediacy of the early warning system supposing a non-tectonic tsunami reoccurs.

This study applied a case study of the Sunda Strait tsunami disaster in 2018. On December 22, 2018, a tsunami disaster occurred in the Sunda Strait due to the volcanic eruption and landslide of Anak Krakatau volcano that claimed 426 lives (Walter et al., 2019). Uniquely, the Meteorology, Climatology, and Geophysical Agency (BMKG) failed to provide information on the arrival of the tsunami as it was not caused by a tectonic earthquake which is the domain of supervision of BMKG (Muhari et al., 2019). The tsunami was triggered by the landslide of sediment from the eruption of Anak Krakatoa volcano that covered an area of 64 hectares to the Sunda Strait (Widiyanto et al., 2020). Monitoring volcanic eruptions is the responsibility of the Center for Volcanology and Geological Hazard Mitigation (PVMBG). Eventually, mutual accusations emerge in the mass media and social media between these national agencies. “Volcanic activities are the domain of PVMBG instead of BMKG,” stated one BMKG official. In an insta story sent on Sunday (23/12), the @infoBMKG account wrote, “A possibility of a tsunami due to volcanic activities falls under the jurisdiction of our colleagues at PVMBG.”

On the other hand, PVMBG refutes these statements as quoted from jawapos.com on December 24, 2018, “Detecting a tsunami is the task of BMKG, no matter the causes. PVMBG does not have an early warning infrastructure. However, one of the sensors located closest to the crater of Anak Krakatau was not working, either because it was hit by lava or hot rock or covered by dust.” Through its Twitter account, the Public Relations Division of BNPB also apologized for the change in information submitted by BMKG according to the latest analysis. The division also stated that the tsunami that hit Pandeglang, Serang, South Lampung, and Tanggamus Districts might have occurred due to a combination of two natural factors, namely the eruption of Anak Krakatau volcano and tidal waves due to the full moon. Each institution insists on fulfilling their duty as stipulated in the legal framework governing them. BMKG operates based on Law No. 31 of 2009 on Meteorology, Climatology and Geophysics, as well as Government Regulation No. 61 of 2008 on BMKG. Meanwhile, PVMBG refers to Presidential Regulation No. 68 of 2015 on the Ministry of Energy and Mineral Resources (KemenESDM) that oversees PVMBG.

One year following the 2018 Sunda Strait tsunami, the Government of the Republic of Indonesia issued Presidential Regulation No. 93 of 2019 on the Strengthening and Development of Earthquake and Tsunami Early Warning Information Systems on December 30, 2019. The Tsunami Early Warning System, presented in Figure 2, is built by structural and cultural elements. The structural element contains the national agencies that are stakeholders in disaster information, namely BMKG and PVMBG for the earthquake monitoring system and the Geospatial Information Agency (BIG) and the Agency for the Assessment and Application of Technology (BPPT) for the sea water level monitoring system. These two data sources were then processed to generate disaster information to be spread to the public in multimodal dissemination of cultural pathways that include government and non-government organizations as disaster stakeholders.

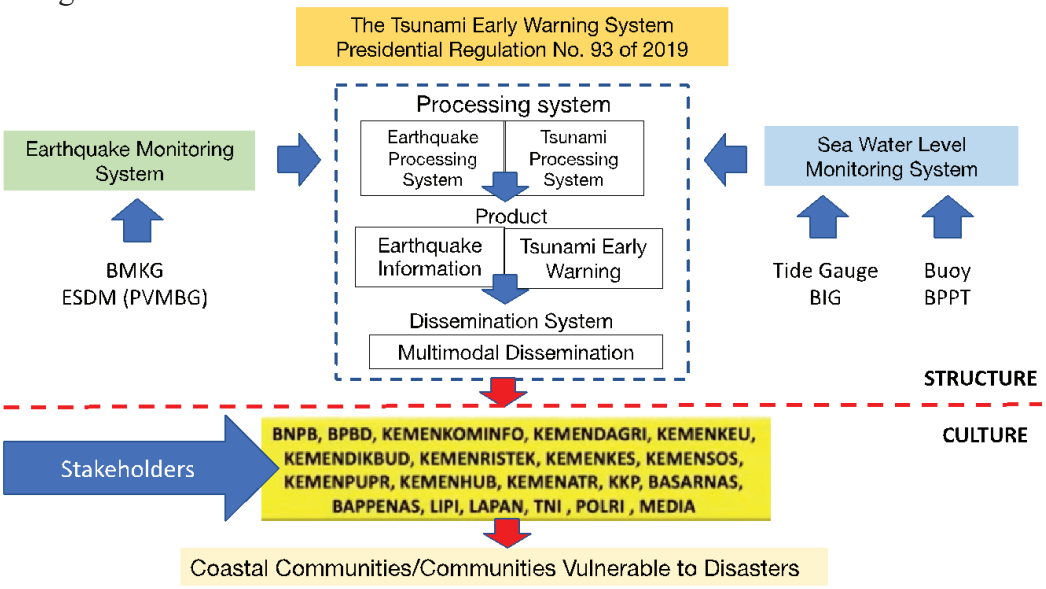


Figure 2. Tsunami Early Warning System (Source: FGD BMKG, 21 June 2001)

The initial objective of Presidential Regulation No. 93 of 2019 is to become a legal umbrella to structurally and culturally create an integrated tsunami early warning system among national agencies involved. However, according to the results of the National FGD held by BMKG in 2021, the expected integrated system has not been realized even after the Presidential Decree has been in effect for nearly 3 years. In addition, the Presidential Decree does not cover the main cause of the commotion between agencies during the 2018 Sunda Strait tsunami, namely a tsunami caused by a volcanic eruption. It only mentions the role of PVMBG in the earthquake monitoring system. The faulty of the expected system was confirmed by the absence of early warning in the event of a tsunami in Seram Island, Central Maluku on June 16, 2021, albeit only 50 cm in height. It indicates the non-existence of a concrete solution to the issue of crisis communication regarding non-tectonic tsunami disasters in Indonesia.

Based on this background, the questions or problems to be discussed in this study are as follows:

1. How are the problems that occurred in the disaster crisis communication process during the Banten tsunami disaster in December 2018?
2. How are the existing disaster policies and their relation to the communication issues regarding non-tectonic tsunami disasters that occurred?
3. What recommendations can be proposed to correct the weaknesses of the non-tectonic tsunami disaster crisis communication policies or regulations?

Literature Review

Previous studies that are the main reference in this paper are as follows. First, Situational Crisis Ccommunication Theory (SCCT). SCCT was originally part of a post-crisis strategy, namely with the aim of improving reputation, adapted to the situation and conditions of the crisis that occurred (Coombs, 1995; Coombs & Holladay, 2002). SCCT was developed from Attribution Theory (Benoit, 1995) by developing a perception of attribution to a crisis to determine its response strategy.

Coombs & Holladay (2010) identified two main processes in crisis communication: (1) crisis knowledge management and (2) stakeholder reaction management. Every crisis requires accurate information and knowledge. This becomes the main challenge, because in times of crisis, especially at the beginning of the incident, information gaps usually appear. The person in charge of the crisis seeks to gain situational awareness. Situational awareness is when the person in charge already has enough information to make a decision. This decision-making process should be communicative between stakeholders. Communication gaps or miscommunication and miscoordination occurred between stakeholder agencies in the case of the Sunda Strait Tsunami, so that information about the occurrence of the tsunami was not conveyed to the community.

Crisis knowledge management involves identifying information sources for crisis-related information, gathering information, analyzing information (knowledge creation), sharing knowledge, and using knowledge to guide decisions. It focuses on the work of the crisis team and other people within the organization who are not ordinarily visible to external stakeholders. Stakeholder reaction management is part of crisis communication by external stakeholders. Since crisis is largely perceptual, stakeholder perception is essential. Stakeholder reaction management represents a communicative effort (words and actions) designed to influence the perception of the stakeholders of crises, organizations in crisis, and the crisis response of organizations. One option is a future built on theoretically driven formal studies that reflect the orientation of the audience. In the development of Situational Crisis Communication Theory (SCCT), Coombs has a lot of emphasis on the framework of stakeholder reaction management.

Second, a study on evidence-based crisis communication (Coombs & Holladay, 2010), which is started with an examination of the basic crisis response strategy, followed by a discussion of the results of crisis communication, and ended with a consideration of how various situational factors affect the effectiveness of the basic crisis response strategy. In a general sense, crisis communication strategies are divided into: (1) managing information and (2) managing meaning. Managing information involves gathering and disseminating crisis-related information. Managing meaning involves trying to influence how people perceive the crisis and/or the organizations involved in the crisis. In the case of the 2018 Sunda Strait tsunami, disaster agencies failed to manage important information about the status of the disaster, leading to their absence in providing volcanic/non-tectonic tsunami information to the public.

Meanwhile, crisis management strategies can be divided into three categories: instructing information, adjusting information, and improving reputation (Coombs & Holladay, 2010). Failure in the management of the non-tectonic tsunami information system has resulted in an oversight by BMKG in instructing information to the public. No evacuation orders were provided on public information channels and social media at that time due to no tsunami early warning issued by BMKG which only released high wave warning. This omission can be avoided supposing the information system for volcanic landslide with the potential for a tsunami from PVMBG is integrated with the tsunami early warning system

from BMKG. However, this integration should be governed by a policy that, up to the present time, has not been available in the legislation of Indonesia.

Third, a study entitled *Social Media in Disaster Risk Reduction and Crisis Management* by Alexander (2014). This study promotes six functions in utilizing social media in disaster management, namely listening to public aspirations, monitoring situations and conditions, integrating social media in disaster risk management, crowd-sourcing and developing the collaboration between parties to overcome the impact of disasters, creating social cohesion and post-disaster healing initiatives, following up activities such as collecting donations and aid, and analyzing and conducting research on the functions of social media in disaster management and communication.

Fourth, a study entitled *Institutional Strengthening for the Role of Mass Media in Disaster Risk Reduction in Japan and Indonesia: An Application of SSM-Based Action Research* by Hardjosoekarto et al. (2013). This study discusses the institutional strengthening of the role of the mass media in disaster risk reduction in Japan and Indonesia. Even though included as a comparative study, the ultimate goal of this study is to identify policy recommendations for the parties involved in disaster risk reduction in Indonesia. Furthermore, this study provides an illustration of action research based on soft systems methodology (SSM) (Checkland, 2000; Checkland & Poulter, 2006; Hardjosoekarto, 2012; Hardjosoekarto et al., 2013; Permatasari et al., 2019), in which the case of Indonesia is debated using a relevant system of purposive activities and a conceptual model developed from the experience of Japan.

The Method of the Study

In developing crisis communication for this case of policy analysis, the authors noticed the need for a systems thinking perspective (Checkland, 1985; Mingers & White, 2010; Pollack, 2006) since disaster communication in the digital era includes complex and complicated problems that require a holistic or systemic way of thinking. The main method employed is SSM based multi-method (Muhammaditya et al., 2021) SSM is a systems thinking-based qualitative method applied to understand problems and develop a conceptual model to solve complex and unstructured problems. SSM comprises seven stages as shown in Figure 2 (Checkland, 2000; Checkland & Poulter, 2006; Hardjosoekarto, 2012). In this study, the implementation was limited up to stage six due to limited time and resources to carry out iterations in stage seven.

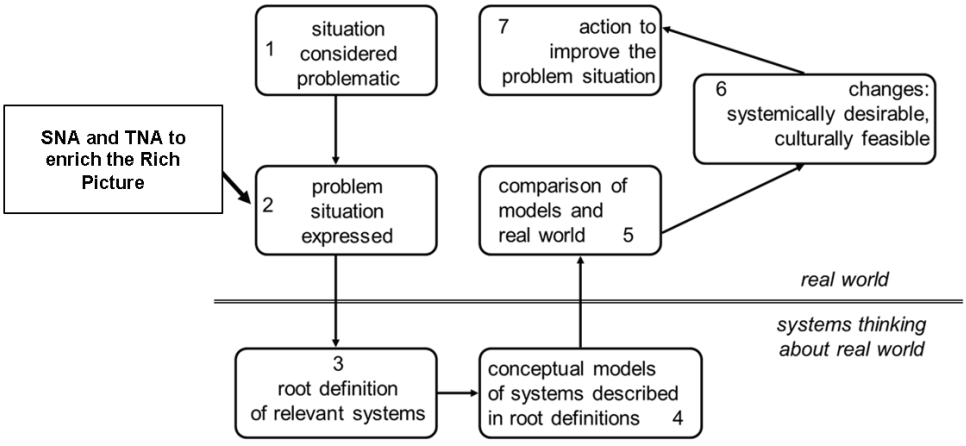


Figure 3. Stages in SSM by Inserting SNA in Stage 2 (Source: Checkland (2000), Checkland and Poulter (2010), Hardjosoekarto (2012), Permatasari et al. (2019))

To enrich the Rich Picture, this study included Social Network Analysis (SNA) (Bogatti et al., 2014) and Textual Network Analysis (TNA) (Segev, 2020) in stage 2 of SSM. SNA was applied to measure and analyze the power of information in the digital media of the main disaster agencies observed from the perspective of these agencies and compared with the perceptions of the disaster-affected community. SNA is used to create a sociograph map that shows the distribution of keywords from the keyword "natural disasters". Meanwhile, TNA is carried out by analyzing Law (UU) No.24 of 2007 concerning Disaster Management. The comparison results enrich the Rich Picture as the output of Stage 2 of SSM.

3.1 Social Network Analysis (SNA)

In SNA visualization, actors are represented by nodes or points and relationships by edges or lines visually depicted in an interaction model between nodes (Borgatti et al., 2014). Network analysis generally aims to observe the relationships between actors in the social structure. SNA has been frequently applied in recent disaster studies, including by Muhammaditya et al. (2021), Meilani and Hardjosoekarto (2020), Hagen et al. (2018), Kim and Hastak (2018), and Guarnacci (2016).

Meilani and Hardjosoekarto (2020) employ SNA to map the actors related to the DRR process with the Digital Weberianism Bureaucracy concept. The findings show that non-official disaster actors such as Indonesian Red Cross Society (PMI) and Non-Governmental Organizations (NGOs) are influential in the process. Hagen (2018) applies SNA from Twitter in a study of the Zika virus disaster in the United States in 2015-2016. Utilizing SNA, Guarnacci (2016) proves the important role of social capital to build disaster resilience communities. Meanwhile, Kim and Hastak (2018) identify a network structure in the disaster security industry in Korea using SNA assisted by Ripple10 software. The data was taken from December 21, 2018 to December 6, 2021, as many as 3000 data were sourced from social media, online news media, blogs, and forums.

3.2 Textual Network Analysis (TNA)

Textual Network Analysis (TNA) is a combination of content analysis and network analysis. According to Segev (2020), TNA is a method in content analysis with a network technique that converts any text into a visual map of words that appear together.

The process of TNA in this study was carried out using Gephi software. Gephi is open source software for graph and network analysis. It utilizes a 3D rendering engine to display large networks in real-time manner and accelerate the exploration (Bastian et al., 2009). The flexible and multi-tasking architecture allows new possibilities to work with complex data sets and generate valuable visual results. The authors employed Gephi Version 0.9.2 for data analysis and network visualization as well as the ForceAtlas2 graph layout (Bastian et al., 2009) that efficiently displays the strategic interests of the actors.

3.3 In-Depth Interviews

In-depth interviews were conducted to obtain qualitative data to answer the first question of the study, namely to describe the crisis situation during the Sunda Strait tsunami in December 2018. Interviews were conducted with parties involved in the implementation of disaster communication during the 2018 tsunami disaster, amounting to six (6) people, including one (1) person from BNPB, one (1) person from BMKG, two (2) people from PVMBG-Kemen ESDM, one (1) disaster expert, and one (1) person from Indonesian National Armed Forces (TNI).

Results

Mapping Disaster Regulations

The government and the House of Representatives (DPR) have drafted various laws and regulations related to disaster and the multi-hazard early warning system. All related policies are compiled in the following table.

Table 1. The Policy Map of Earthquake, Tsunami and Volcanic Eruption

No	Disaster	Legal Regulations
1	Earthquake and tsunami	Law 31/2009 on Meteorology, Climatology and Geophysics President Regulation 61/2008 on BMKG President Regulation 68/2015 on ESDM President Regulation 93/2019 on the Strengthening and Development of Earthquake and Tsunami Early Warning Information Systems
2	Volcanic eruption	President Regulation 68/2015 on KemenESDM

As presented in the table, most regulations focus on two elements in a multi-hazard early warning system, namely risk knowledge and monitoring and warning services. Furthermore, several regulations also cover the elements of dissemination and communication. The authors then dissected the table into a stakeholder analysis for the types of earthquake and tsunami and volcanic eruption.

Table 2. Stakeholders in Charge of Earthquake and Tsunami Disasters

K/L/D/I	Risk Knowledge	Monitoring & Warning	Dissemination & Communication	Response Capability
BMKG	No	Yes (Operational)	Yes (Operational)	No
Kemen ESDM	Yes (Operational)	Yes (Operational)	No	No
BNPB	Yes (Operational)	Yes (Operational)	Yes (Operational)	Yes (Operational)
BPPT	Yes (research)	Yes (research)	No	No
BIG	Yes (supporting)	Yes (supporting)	No	No
LAPAN	Yes (supporting)	Yes (supporting)	No	No

Source: Processed from peraturan.go.id

Observed from the table, BMKG has duties and functions in the elements of monitoring and warning as well as dissemination and communication. Furthermore, Kemen ESDM, particularly PVMBG, has duties and functions in the elements of risk knowledge as well as monitoring and warning. BNPB has duties and functions in the elements of dissemination and communication as well as response capability. BPPT has duties and functions in the elements of risk knowledge as well as monitoring and warning as part of research. Meanwhile, BIG and National Institute of Aeronautics and Space of Indonesia (LAPAN) have duties and functions in the elements of risk knowledge as well as monitoring and warning to support decision making.

Table 3. Stakeholders In Charge of Volcanic Eruption Disasters

K/L/D/I	Risk Knowledge	Monitoring & Warning	Dissemination & Communication	Response Capability
BMKG	No	Yes (supporting)	No	No
Kemen ESDM	Yes (Operational)	Yes (Operational)	Yes (Operational)	No
BNPB	Yes (Operational)	Yes (Operational)	Yes (Operational)	Yes (Operational)
BPPT	Yes (research)	Yes (research)	No	No
BIG	Yes (supporting)	Yes (supporting)	No	No
LAPAN	Yes (supporting)	Yes (supporting)	No	No

Source: Processed from peraturan.go.id

In the case of a volcanic eruption disaster, six (6) ministries/agencies involved in the early warning system have been identified (see table 5.7). Kemen ESDM, particularly PVMBG, has duties and functions in the elements of risk knowledge, monitoring and warning, as well as dissemination and communication. BMKG, specifically the Deputy for Meteorology and Geophysics, has duties and functions in the monitoring and warning element to support decision making. BNPB has duties and functions in the four elements of the early warning system. BPPT has duties and functions in the elements of risk knowledge as well as monitoring and warning as part of research. Then, BIG and LAPAN have duties and functions in the elements of risk knowledge as well as monitoring and warning to support decision making.

One unique aspect is the role of TNI/ Indonesian National Police (Polri). Referring to Table 4, TNI and Polri have specific duties and functions as supporters in increasing community responsiveness. However, the results of the analysis interestingly show that TNI and Polri have proven to be two institutions referred to by the public for disaster information compared to other disaster agencies. The informant from TNI serving as Commander of the Military District Command (Dandim) of Serang District at the time of the disaster states:

"Corporal of TNI Munip was the first officer to come to the disaster site. He immediately reported to his superiors, namely the Commander of a Military Subdistrict Command (Danramil) of Cinangka Subdistrict, Captain Gunadi, who then rushed to report the disaster to Dandim of Cilegon, Lieutenant Colonel Rico Ricardo, who then coordinated with the Cilegon City and Disaster Risk Reduction (DRR) Forum of Serang District to take assistance measures."

Therefore, it is necessary to consider affirming the involvement of TNI and Polri in the process of disseminating information and communication as these two institutions have networks to the lowest level of society.

Table 4. Stakeholders Supporting Disaster Management in Indonesia

K/L/D/I	Risk Knowledge	Monitoring & Warning	Dissemination & Communication	Response Capability
Kemen Kominfo	No	No	Yes (infrastructure)	No
Kemendikbud	No	No	No	Yes (education)
Kemenag	No	No	No	Yes (education)
Kemenristekdikti	Yes (research)	Yes (research)	Yes (research)	Yes (research)
Kemen ATR/BPN	No	Yes (supporting)	No	No
Kemen PPN/Bappenas	Yes (supporting)	Yes (supporting)	Yes (supporting)	Yes (supporting)
Kemenkeu	Yes (supporting)	Yes (supporting)	Yes (supporting)	Yes (supporting)
Kemendagri	No	No	No	Yes (supporting)
LIPI	Yes (research)	Yes (research)	Yes (research)	Yes (research)
TNI	No	No	No	Yes (supporting)
POLRI	No	No	No	Yes (supporting)
Governor	No	No	Yes (Operational)	Yes (Operational)
Head of District/ Mayor	No	No	Yes (Operational)	Yes (Operational)

Source: Processed from peraturan.go.id

4.2 Processing Big Data on Disasters

SNA using Ripple10 and Gephi software generates several findings. First, the sociograph map from the Ripple10 software, as illustrated in the following figure, shows the distribution of words from the keyword "natural disasters". The data were taken from December 21, 2018 to December 6, 2021 with a total of 3000 data from social media, online news media, blogs, and forums.

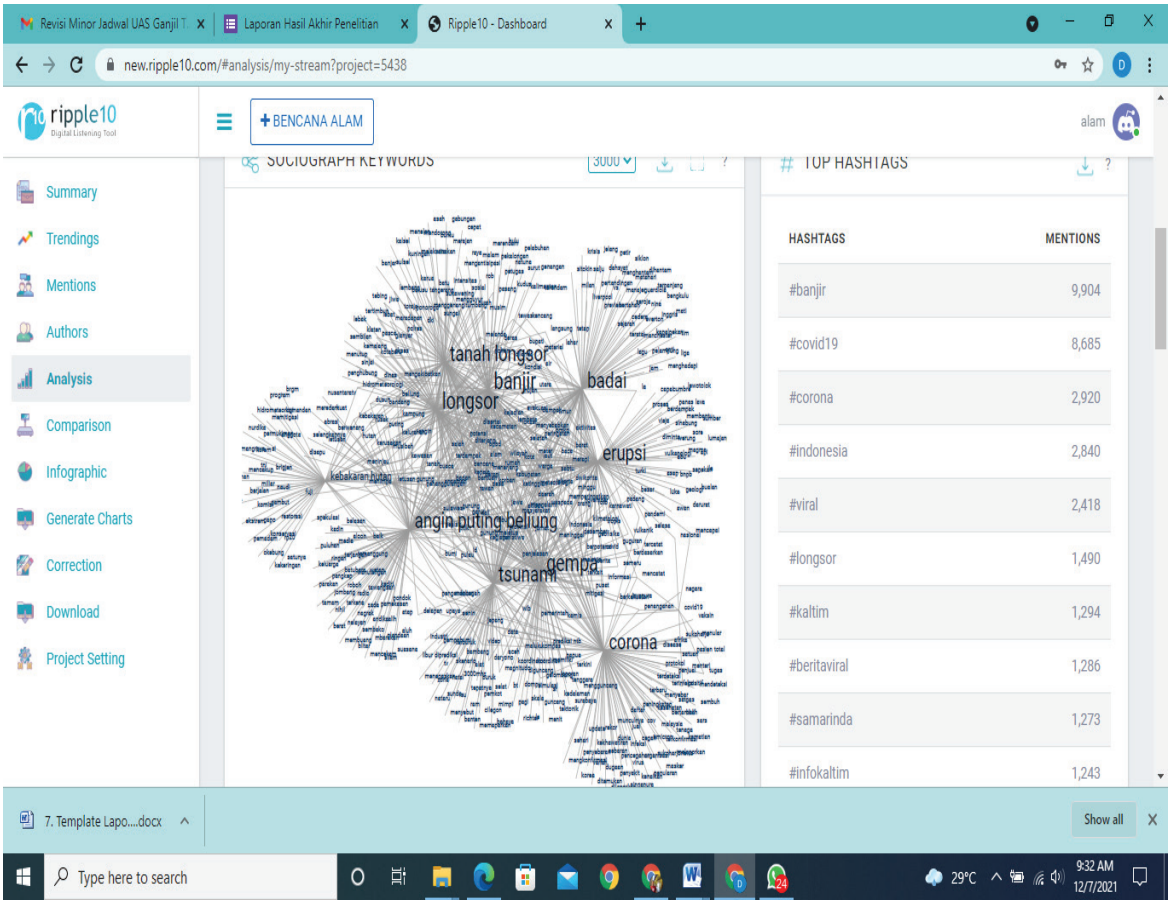


Figure 4. SNA from the Keyword 'Natural Disasters' using Ripple10 Software

The sociograph of these words shows the groupings from the keyword natural disaster. Nine main words emerge from the keyword, namely floods (banjir) and landslides (tanah longsor) in one group, then storms (badai), eruptions (erupsi), tornadoes (angin puting beliung), and corona, which stand alone each, then tsunamis (tsunami) and earthquakes (gempa) in one group. The word tsunamis is closer to earthquakes than to eruptions. Thus, it can be visually concluded that the public still associates the word tsunamis with earthquakes rather than eruptions.

Discussion

The authors analyzed and solved the problematic situations with SSM. **The first stage** is to determine the Client, Practitioner, and Owner (CPO) of the issue.

Table 5. CPO – Stage One of SSM

Client	Postgraduate Study Program of Communication Science of UI
Practitioner	Dani Akhyar (researcher and SSM practitioner) Hendriyani and Sudarsono Hardjosoekarto (supervisor)
Owner	BNPB, BMKG, PVMBG, Commission VIII of DPR RI

5.1 The Rich Picture Corroborated by SNA and TNA Visualizations

Stage 2 of SSM, according to Figure 3, is to compile a Rich Picture, which is an illustration of the occurring problematic situations. At this stage, the authors included TNA by analyzing Law (UU) No. 24 of 2007 on Disaster Management. The following are the results of the network graph:

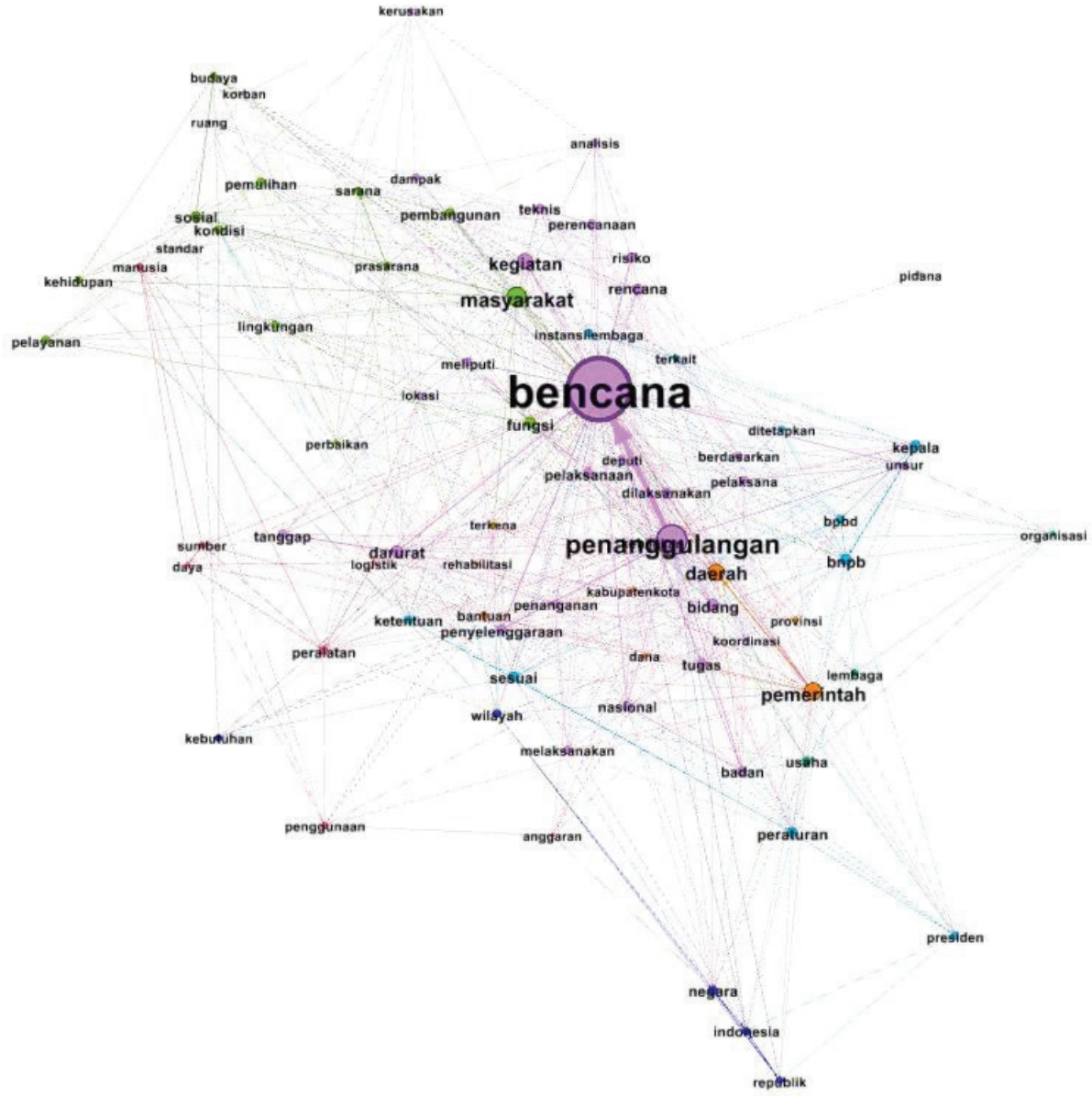
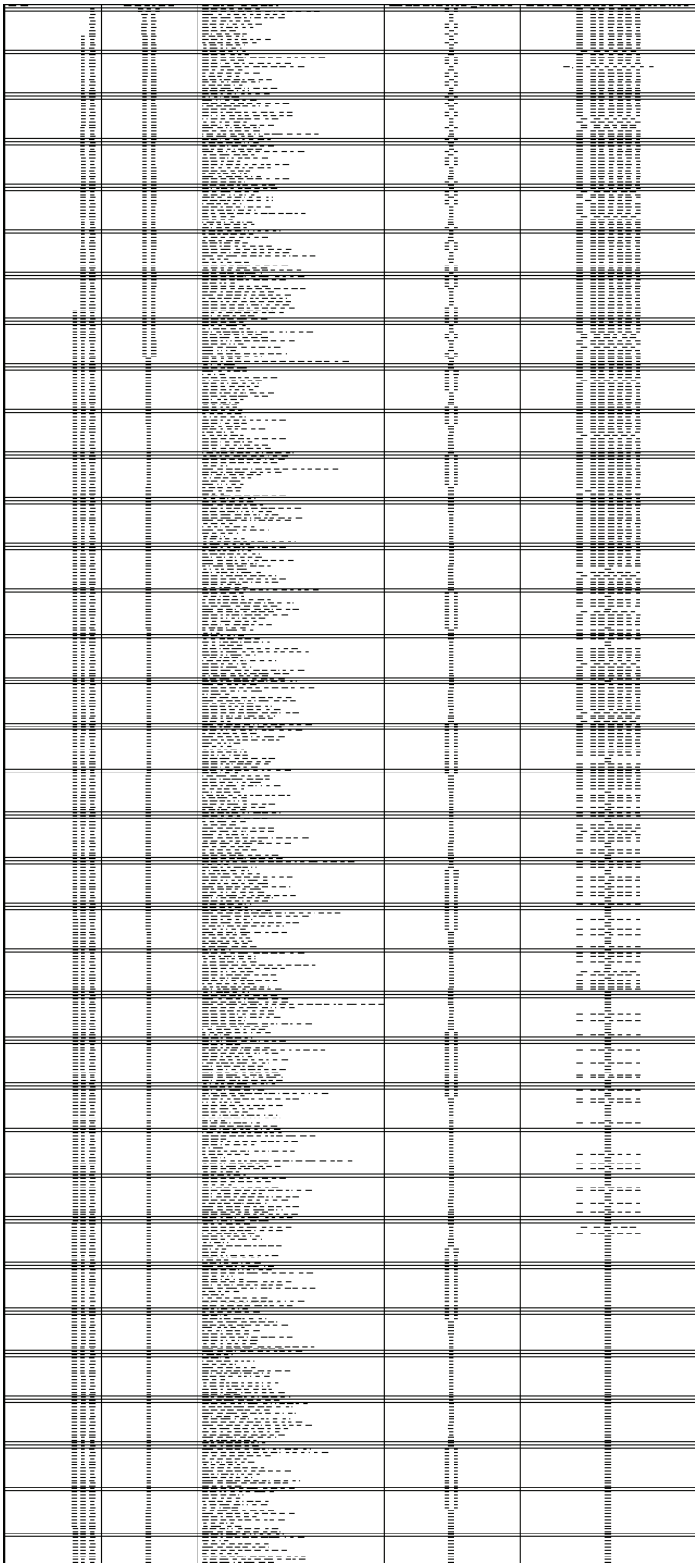


Figure 5. TNA Graph from Law 24/2007 on Disaster Management.
Source: Processed with Wordij and Gephi 0.9.2 software

Statistics from the TNA graph is shown in the following table.

Table 6. TNA from UU 24/2007



Source: Processed with Wordij and Gephi 0.9.2 software (only 70 lines displayed).

As presented above, the words have been sorted from the largest to the smallest degree value. Degree indicates the number of connections owned by a node. A greater degree value indicates a greater connection of the node with other nodes. The word disaster (bencana) has the largest degree, namely 311, followed by the word response (penanggulangan) at 141, and so forth. Despite the large degree value, the word disaster is not followed by a more detailed definition.

The table also displays that the biggest betweenness centrality is obtained by the word disaster with a value of 0.405546. It implies that the word becomes the strongest connector or intermediary. The betweenness centrality value shows how much a node connects (bridges) one node to another. Meanwhile, in terms of modularity class, it is evident that the highest number in the column is 11, indicating 11 modular communities in the SNA graph. Modularity measures how well a network is divided into modular communities.

Referring to the results of SNA and TNA and the qualitative data from the interviews, the authors compiled the Rich Picture as follows:

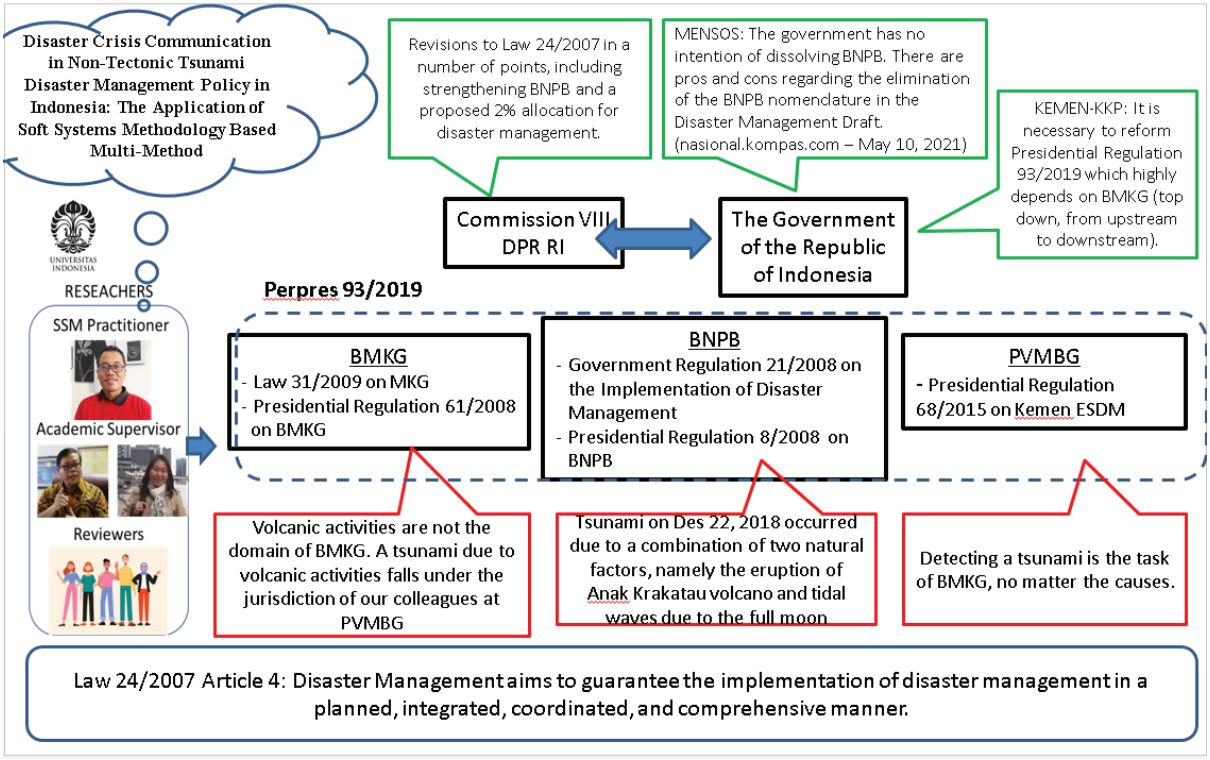


Figure 6. Rich Picture from the Problematic Situations

The Rich Picture reveals several clashes of worldview. First, Article 4 of Law No. 24 of 2007 on Disaster provides the foundation that Disaster Management aims to guarantee the implementation of disaster management in a planned, integrated, coordinated, and comprehensive manner. However, in the case of the 2018 Sunda Strait tsunami, the content of the article was not achieved on the field. Polemics and mutual accusations between disaster agencies suggest the lack of an integrated and comprehensive coordination. Each agency perceived that they had implemented their main duties and functions according to the legal umbrella. Based on the legal regulations, BMKG stated that tsunamis caused by volcanic activities were the responsibility of PVMBG instead of theirs. Meanwhile, in compliance with the legal regulations, PVMBG rejected the accusation and claimed that tsunami disasters, no matter the cause, were the responsibility of BMKG. Meanwhile, BNPB, as a coordinating agency for disaster management according to government regulations, delivered its own opinion

that the Sunda Strait tsunami was caused by two factors, namely the eruption of Anak Krakatau volcano and the tidal wave caused by the full moon.

One year following the 2018 Sunda Strait tsunami, precisely on December 30, 2019, the government issued Presidential Regulation 93/2019 on the Strengthening and Development of Earthquake and Tsunami Early Warning Information Systems. The purpose of the Presidential Decree is to emphasize the development of an integrated tsunami early warning information system that involves various disaster agencies such as BMKG and PVMBG. However, several years following its ratification, the system has not yet achieved, missing several non-tectonic tsunami disasters, such as in Maluku in June 2021. One researcher from the Ministry of Marine Affairs and Fisheries (KKP) mentioned the need for reform of Presidential Regulation 93/2019 which highly depends on BMKG (top down, from upstream to downstream). In fact, recent technology and bottom-up initiatives are currently available to assist in solving the issue.

Clashes of worldview also occur at the legislative and executive levels. The starting point is the proposed revision of Law No. 24 of 2007 in the 2021 national legislation program. The government and DPR agree that the law has to be revised considering that numerous aspects need to be updated in accordance with the types of disasters that occurred in recent years. However, both have different opinions concerning the function of BNPB in the future. As quoted from Kompas.com on May 10, 2021, the government through the Minister of Social Affairs eliminated the nomenclature of BNPB in the Disaster Management Draft submitted. DPR stated their disagreement and even proposed the strengthening of BNPB and a 2% budget allocation in each region for disaster management. As a result of this difference in opinion, the National Legislation Program (Prolegnas) process was hampered and invalidated in 2021 and will only be discussed again in 2023. It suggests that improvements in disaster management will be achieved in the future.

5.2 Determining Root Definition

The third stage is to determine the root definition. The technique applied is to answer the questions about what is done (P), how to do it (Q), and why it is done as an objective (R) (Checkland & Poulter, 2006). The root definition of this study is defined as follows:

The desire and action to improve government regulations/policies regarding disaster crisis communication systems in digital media (P) by using a system that integrates all digital media platforms from disaster stakeholders (Q) to increase the effectiveness of disaster crisis communication centers in the disaster management process (R).

The compilation of PQR will be compared with the CATWOE analysis consisting of the elements of Customer, Actor, Transformation, Weltanschaaung (Worldview), Owners, and Environment (Hardjosoekarto, 2012; Permatasari et al., 2019).

Table 7. CATWOE Analysis (Checkland and Poulter 2006; Hardjosoekarto 2012)

Customers	Commission VIII of DPR RI, BNPB, BMKG, PVMBG, BPBD, communities in disaster-prone areas
Actors	Commission VIII of DPR RI, Postgraduate of Communication Science of UI
Transformations	To refine the definition of disaster by adding non-tectonic tsunamis to the list of types of disaster, improve one-stop coordination among disaster agencies for disaster communication, and increase community participation in disaster information
Worldview	Up-to-date disaster laws and regulations with the types of disasters that occur which contain an effective crisis communication system
Owner(s)	DPR and the Government of the Republic of Indonesia (RI)
Environment	Social, political, technological, and budget constraints

5.3 Formulating a Conceptual Model

The fourth stage of SSM is to formulate a conceptual model. The purpose of this conceptual model is to answer the desired transformation needs, namely an integrated DRR crisis communication system among agencies to become a reliable reference for the community. The conceptual model developed focuses on the transformation or improvement of Law No. 24 of 2007 as follows.

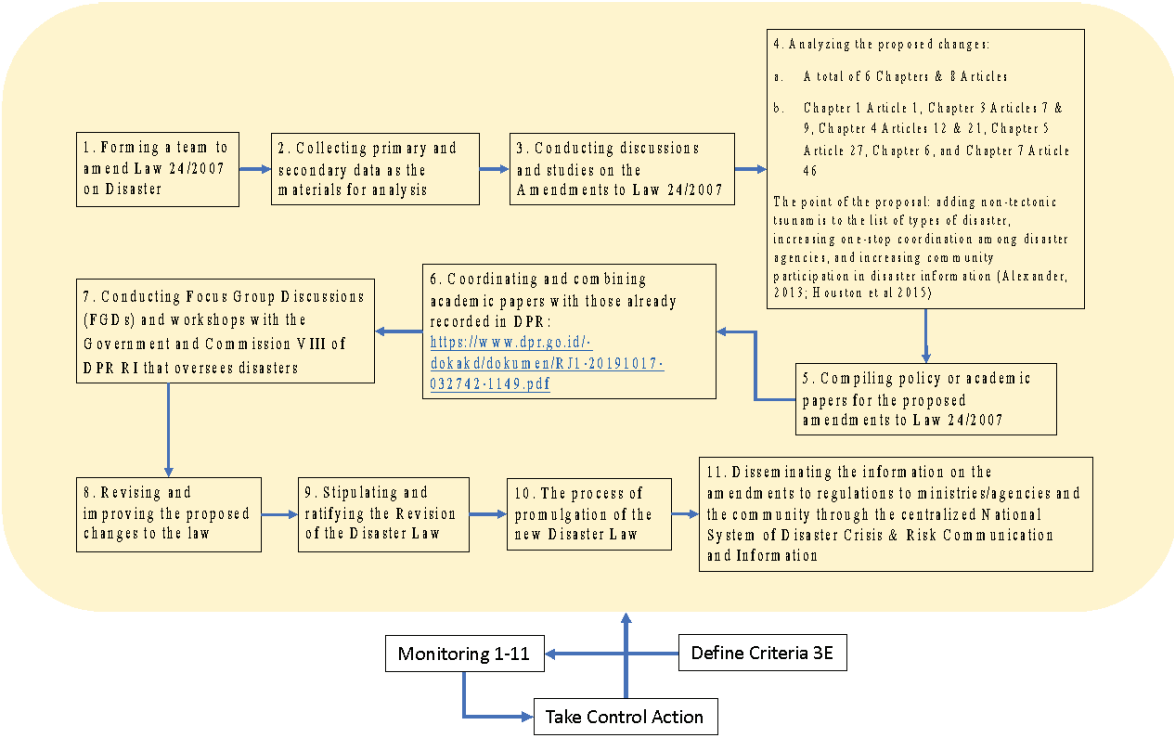


Figure 7. Conceptual Model of Relevant Systems

The conceptual model can be explained in the following steps:

Table 8. *Human Activity System* in the Conceptual Model at the Macro Level

Stage	Human Activity	Explanation	Theoretical Reflection
1	Forming a team to amend Law 24/2007 on Disaster	Amendments to laws can be proposed by the government or DPR. In this regard, the amendments to the disaster law have been proposed by the Commission VIII of DPR since 2020	-
2	Collecting primary and secondary data as the materials for analysis	It is necessary to collect data, facts, and information to be used as the materials for proposing changes to the disaster law	-
3	Conducting discussions and studies on the Amendments to Law 24/2007	The materials for the amendments to the law are discussed in various forums to obtain input from various segments of society	Listening to public aspirations (Alexander, 2014)
4	Analyzing the proposed changes: a. A total of 6 Chapters & 8 Articles b. Chapter 1 Article 1, Chapter 3 Articles 7 & 9, Chapter 4 Articles 12 & 21, Chapter 5 Article 27, Chapter 6, and Chapter 7 Article 46 The point of the proposal: adding non-tectonic tsunamis to the list of types of disaster, increasing one-stop coordination among disaster agencies, and increasing community participation in disaster information (Alexander, 2013; Houston et al 2015)	Examining and analyzing the chapters, articles, and paragraphs in Law 24/2007 for amendments, particularly in terms of digital-based disaster crisis communication for non-tectonic/volcanic tsunamis	Building situational awareness in the community in a systematic manner (Coombs, 2007), inviting the participation of the affected communities to provide disaster information (Alexander, 2014), and one-stop coordination between institutions (Alexander, 2014; Houston et al, 2015)
5	Compiling policy or academic papers for the proposed amendments to Law 24/2007	Compiling a complete academic text as an official document for the proposed amendments to Law 24/2007 on disaster	-
6	Coordinating and combining academic papers with those already recorded in DPR: https://www.dpr.go.id/-dokakd/dokumen/RJ1-20191017-032742-1149.pdf	Combining academic papers from this study with academic papers that have been prepared by DPR in the link. It shows the necessity to coordinate with the material team from DPR RI	-
7	Conducting Focus Group Discussions (FGDs) and workshops with the Government and Commission VIII of DPR RI that oversees disasters	FGDs are conducted to provide official input to the government and Commission VIII of DPR RI regarding the points of amendments to the disaster law	Listening to public aspirations (Alexander, 2014)

8	Revising and improving the proposed changes to the law	Making revisions or improvements based on input from the government and Commission VIII of DPR RI	-
9	Stipulating and ratifying the Revision of the Disaster Law	Subsequent to the completion of revision process, the government and DPR stipulate and pass the new disaster law	-
10	The process of promulgation of the new Disaster Law	Promulgating the new disaster law in the state gazette	-
11	Disseminating the information on the amendments to regulations to ministries/agencies and the community through the centralized National System of Disaster Crisis Communication and Information	Disseminating and educating the new disaster law to the community	-

There are three main criteria for testing the conceptual model, namely efficacy, efficiency, and effectiveness. Efficacy means that the model built provides a solution as needed. Efficiency means the minimum use of resources with optimal results. Meanwhile, effectiveness shows that the model can be applied practically in the field. Table 4 shows the translation of the meaning of the three criteria in this study.

Table 9. Testing Criteria 3E (Hardjosoekarto, 2012; Hardjosoekarto et al., 2013; Permatasari et al., 2019)

Efficacy – 1E	The conceptual model built is able to accommodate the needs for policy revisions to disaster regulations in Indonesia
Efficiency – 2E	The policy revisions of the disaster law will improve numerous processes at once through derivative legal regulations that will be decided (Government Regulation, Presidential Decree, etc.)
Effectiveness – 3E	Changes to the Law on Disaster are needed to improve disaster management in Indonesia comprehensively.

5.4 The Comparison of the Conceptual Model with the Real World

The sixth stage is to compare the conceptual model with the real world, one of which is by observing all activities in the conceptual model. The following is the comparison table.

Table 10. Comparison of the Conceptual Model with the Real World

No	Activities in the Model	Available?	Who are the actors?	Good/Bad?	Alternatives?
1.	Forming a team to amend Law 24/2007 on Disaster	Yes, but in a draft form, still in Commission VIII of DPR			
	DPR and the Government of RI	Relatively good, yet the establishment is delayed	It is imperative to immediately ratify the draft to improve disaster management		
2.	Collecting primary and secondary data as the materials for analysis	Yes, from disaster stakeholders	DPR, BNPB, & disaster agencies	Good	Improving coordination as well
3.	Conducting discussions and studies on the Amendments to Law 24/2007	Yes	DPR, BNPB, & disaster agencies	Good	Improving coordination as well
4.	Analyzing the proposed changes:				
a.	A total of 6 Chapters & 8 Articles				
b.	Chapter 1 Article 1, Chapter 3 Articles 7 & 9, Chapter 4 Articles 12 & 21, Chapter 5 Article 27, Chapter 6, and Chapter 7 Article 46				
●	The point of the proposal: adding non-tectonic tsunamis to the list of types of disaster, increasing one-stop coordination among disaster agencies, and increasing community participation in disaster information (Alexander, 2013; Houston et al 2015)	Yes	DPR, BNPB, & disaster agencies	Relatively good considering its long process	The three main proposals should be accommodated in the new disaster law to ensure they significantly improve the root cause of the non-tectonic tsunami disasters
5.	Compiling policy or academic papers for the proposed amendments to Law 24/2007	Yes, in constant improvements	DPR, Universitas Indonesia	Relatively good, yet needs several improvements	Involving DPR at this stage
6.	Coordinating and combining academic papers with those already recorded in DPR: https://www.dpr.go.id/-dokakd/dokumen/RJ1-20191017-032742-1149.pdf				

Not yet	Authors, Universitas Indonesia	Relatively good	Improving coordination as well		
7.	Conducting Focus Group Discussions (FGDs) and workshops with the Government and Commission VIII of DPR RI that oversees disaster				
	Yes, have already conducted	DPR, Universitas Indonesia, and all disaster agencies	Relatively good, yet merely a forum with no improvements in coordination	Forming FGDs and improving coordination	
8	Revising and improving the proposed changes to laws	Yes, ongoing	DPR RI, the government of RI/ relevant ministries, disaster agencies, universities	Relatively good	Synchronizing inputs among stakeholders
9	Stipulating and ratifying the Revision of the Disaster Law	Not yet, DPR has backtracked from the 2021 target	DPR and the Government of RI	Not available	It is imperative to immediately stipulate and ratify the revision considering the increasing number of disasters every year
10.	The process of promulgation of the new Disaster Law	Not yet, DPR has backtracked from the 2021 target	DPR and the Government of RI	Not available	It is imperative to immediately stipulate and ratify the revision considering the increasing number of disasters every year
11	Disseminating the information on the amendments to regulations to ministries/agencies and the community through the centralized National System of Disaster Crisis Communication and Information	Not yet	DPR, the Government of RI, and disaster stakeholders	Not available	The one-stop information center has played a role

5.5. Recommendations for Further Actions

The sixth and seventh stages of SSM concern about transformations/amendments and recommendations. According to Checkland (2000) and Checkland and Poulter (2006), the conceptual model is tested in Stage 6 to ensure it is systematically desirable and culturally feasible. Subsequent to discussing the results of this study with several disaster stakehold-

ers, several conclusions were obtained that the system built has met the criteria of being systematically desirable and culturally feasible with several important notes.

First, the revision to Law No. 24 of 2007 on Disaster Management and its derivative regulations, namely Government Regulation No. 21 of 2008 on the Implementation of Disaster Management and more specifically Presidential Regulation 93/2019 on the Strengthening and Development of Earthquake and Tsunami Early Warning Information Systems. The conceptual model developed suggests the amendments to Law No.24/2007, which, supposing approved, will be followed by several amendments to the Government Regulation and Presidential Regulation, including adding volcanic disasters as the cause of tsunamis, adding TNI as partners of BNPB and BPBD in disaster management, and community participation in providing tsunami early warning. The following are the proposed amendments to Law 24/2007. The core of the revision, based on Houston (2015) and Alexander (2013), includes the addition of non-tectonic (volcanic) disaster crisis types in crisis types as a form of improvement in crisis knowledge management from SCCT theory. The proposal establishes a digital-based integrated disaster crisis information and communication center by collaborating on the social media management of all disaster agencies, and affirming the role of the TNI and police as supporting actors in disaster crisis communication.

Table 11. The Proposed Amendments to Law 24/2007.

Chapter	Article	Description
1 – General Chapter	1	The definitions and types of disasters need to be updated by adding new types of disasters, for example non-tectonic tsunamis, liquefaction, the Covid-19 pandemic, etc.
3 – The Responsibilities and the Authority of the Central and Local Governments	7 9	It needs to be emphasized that the central and local governments are implementers, not merely responsible for disaster management. In article 7, the use of technology should be clarified as it merely refers to sources of disaster threats, even though technology can also be used to improve disaster response capabilities, for example by using digital media.
4 - Institutional	12	The duty of BNPB, in compliance with article c, is to convey information on activities to the public. Listening to public aspirations should be added to capture disaster information (a bottom-up approach).
4 - Institutional	21	It is necessary to add the duties of BPBD, namely providing disaster information to the public and listening to public aspirations regarding disaster information (a bottom-up approach).
5 - Community Rights and Responsibilities	27	Article c mentions providing correct information to the public about disaster management. However, it is also essential to add that appropriate information should also be provided to disaster agencies. The education that should be provided to the public is concerning the causes of tsunamis which are not merely from tectonic earthquakes but also from volcanic eruptions
6 - The Role of Corporations and International Institutions		This chapter should also add the roles of TNI and Polri in addition to those of the private sector/business institutions and international institutions. As conveyed by the SNA results, TNI and Polri are the main references for the community when a disaster occurs.
7 – The implementation of Disaster Management	46	Article d regulates the dissemination of disaster warning information while article e regulates the actions taken by the community. It should be added that the community is not only expected to take action, but also provide disaster information.

Second, the integration of information systems between these agencies to become the pillar of an integrated disaster information system in Indonesia. The conceptual model produced in this study is expected to be the core of the digital-based crisis communication process in the system.

Third, strengthening disaster education more massively to the community. Currently, the

media in Indonesia still sporadically report disaster information to the public when a disaster occurs. Frequently, factual and emotional elements are mixed up in the news, obscuring the essence of the disaster information to the public. Indonesia needs to follow the example from Japan with the multi-channel NHK reporting system which is the sole reference for disaster information and communication in Japan (Hardjosoekarto et al., 2013).

Theoretically, examined from SCCT theory, the two communication processes during a disaster, namely crisis knowledge management and stakeholder reaction management (Coombs, 1999, 2007), this study focuses on the first. Knowledge creation during a crisis begins with an introduction to a disaster situation (situational awareness). Situational awareness as part of the process of forming crisis knowledge (crisis knowledge management) in the 2018 Banten tsunami case was formed by three elements, namely non-disaster institutions such as TNI and Polri, BMKG disaster agency which is most widely known by the public, and influential individuals/community leaders in society. The early warning information system should play the first role in providing early warning when a disaster occurs.

Conclusion

This study generates several conclusions. The first conclusion is related to the first question of the study, namely an illustration of the problems that occurred in the disaster crisis communication process during the Banten tsunami disaster in December 2018. The problem situation is successfully described in Stage 2 of SSM, namely the rich picture presented in Figure 6. Crisis communication at the event of the disaster did not run optimally due to a crisis of communication and coordination between disaster national agencies, namely BMKG and PVMBG. Each stakeholder holds a legal basis for its operation which turns out to be contradictory to one another. The 2018 Sunda Strait tsunami disaster was caused by the landslide from volcanic eruptions. It is not included in BMKG monitoring, whose duties only examine tsunamis caused by tectonic earthquakes. PVMBG as an agency that monitors eruptions, in compliance with the regulations, is also not in charge of tsunamis.

The second conclusion is related to the first conclusion and the second question of the study, which maps the existing disaster policies and how these policies do not provide a solution to the crisis communication of the non-tectonic tsunami disasters that occurred. Several policy regulations stipulating earthquakes, tsunamis, and volcanic eruptions are presented in Table 1. Referring to the lessons from the 2018 Sunda Strait tsunami and the SNA and TNA results, the authors propose amendments to Law 24/2007 as the highest policy umbrella contained in the conceptual model in Figure 7 and several other regulations, as detailed in Tables 11, 12, and 13. The new regulations are expected to include the new disaster types and better flow of communication and coordination among agencies to achieve better disaster crisis communication. These proposed amendments are the response to the final question of this study.

Methodologically, this study shows that the application of SNA and TNA can enrich the illustration of Rich Picture at Stage 2 of SSM. Thus, this study offers a new variant of SSM based Multi-Method, namely by adding TNA in the second stage.

Theoretically, this study explores one of the important elements in Situational Crisis Communication Theory (SCCT), namely crisis knowledge management (Coombs & Holladay, 2010). An important element in knowledge creation in a crisis is situational awareness that emphasizes the human factor as a source of knowledge by examining the situation and conditions before, during, and after the crisis.

At the state level, situational awareness and knowledge creation regarding a crisis is

relatively more complicated as it involves the lives and conditions of the people affected by disasters. Thus, firm yet flexible policies/regulations are essential to accommodate the increasing types and impacts of disasters. The study reveals that the knowledge possessed by humans, albeit assisted by a computerized system, is considerably limited, particularly dealing with crisis phenomena that have not previously been defined in the human knowledge system, in this regard non-tectonic tsunami disasters which have not yet been included in the tsunami early warning system despite its several occurrences in Indonesia.

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