

The Presence of Digital Volunteer and The Absence of Government in Handling Disaster Management on X

Rizky Fauziah¹, Rehia Karenina Isabella Barus¹, Evi Yunita Kurniaty², Nina Angelia³, Beby Masitho Batubara³, Audia Junita³

¹Communication Science, Universitas Medan Area, Indonesia

²Government Studies, Universitas Medan Area, Indonesia

³Public Administration, Universitas Medan Area, Indonesia

Correspondence: Rizky Fauziah, Communication Science, Universitas Medan Area, Indonesia.

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Abstract

Extreme climate change around the world has disrupted the seasonal timeline and made it difficult to predict natural disasters, including in Indonesia. Data from BNPB (Badan Nasional Penanggulangan Bencana or National Board for Disaster Management) recorded that from January 1 to May 26, 2025, there were a total of 1,162 natural disaster events. The need for disaster information has become a hot topic in public discourse, especially on X, because formal government information sources are not disseminated quickly, thereby giving rise to digital volunteers.

The evolution of public opinion concerning disaster-related information can be effectively examined through social media platforms. Indonesia ranks among the top five countries globally with the highest number of users on X, making the dissemination of disaster information on this platform a matter of strategic importance. Given the platform's extensive reach, it is imperative for government agencies to actively engage in shaping and guiding disaster-related narratives on X. Such involvement would help mitigate misinformation and influence public perception regarding disaster management. This study utilizes data from X to track the circulation of disaster-related content across Indonesia, focusing specifically on the period from May 1st to May 31st, 2025, during which a notable surge in disaster events occurred. The primary aim of this research is to explore how digital volunteers disseminate information about natural disasters on X, thereby addressing the informational void left by the absence of timely official communication. Key analytical dimensions include user volume, leading influencers, top-performing tweets, user interaction networks, and sentiment dynamics. The study employs social network analysis as its methodological framework, with X serving as the principal data source.

The findings of this study reveal that the dissemination of natural disaster information on the X platform is predominantly driven by digital volunteers, largely due to the limited presence and communication from government agencies. A total of 1,476 users were actively involved, forming 2,157 distinct communication networks. Sentiment analysis indicates that user responses comprised 16% positive, 39% negative, and 45% neutral expressions. Within these networks, the most influential account identified was @tanyakanrl, operated by an individual unaffiliated with formal institutions. Further analysis confirms that the leading source of disaster-related information originates from a member of the digital volunteer community, effectively filling the informational void left by the government's absence on the platform.

Keywords: social network analysis, disaster information, digital volunteer, X, Indonesia

1. Introduction

Natural disasters in Indonesia are having an increasingly significant impact each year because such events no longer depend on a particular season or time. Global climate change has become the primary cause, especially for Indonesia, which is located within the Pacific Ring of Fire (Kurnia et al., 2020). Disasters are occurring rapidly, in succession, unpredictably, and even in areas that are not typically considered disaster-prone, making them difficult to foresee. The unique geographical position of Indonesia makes it a country highly susceptible to disasters stemming from various elements, including water, air, and land (Simanjuntak et al., 2025).

Data from BNPB (Badan Nasional Penanggulangan Bencana) or National Board for Disaster Management shows that the total number of disasters from January to May 2025 was 1,162, with May 2025 experiencing a significant surge—31 natural

disasters occurred on May 10–11, including 8 major disasters that were classified as emergencies. In such a short, urgent time frame, the government is expected to lead in delivering and disseminating disaster information. However, reality paints a different picture; the government is notably absent on social media, and its role has been filled by digital volunteers. Digital volunteers are individuals who voluntarily use their smartphones to help spread information on social media (Fauziah, 2025).

Social media has emerged as the most widely used medium for disseminating disaster-related information (Rasyid, 2024). It serves as the preferred platform due to its ability to facilitate information exchange and foster interaction among users. In times of crisis, timely information becomes an urgent necessity, enabling affected individuals to connect with external sources that can provide critical assistance (Yuliana, 2023). The dissemination of disaster-related information is essential, as public awareness regarding disaster management remains limited, often resulting in a high casualty rate during catastrophic events. Raising awareness through effective information distribution plays a crucial role in helping communities prepare for disasters, ultimately reducing the number of victims and minimizing losses (Arthadia & Hartini, 2024). X provides a rapidly growing volume of data through user's daily posts (Ni Komang et al., 2022).

Users on X who are engaged in the conversation are part of the digital volunteers who voluntarily assist in circulating disaster information. Digital volunteers are individuals who donate their time, energy, and money to help disaster victims (Fauziah, 2025). The measurement of public opinion through social media in real time is the long-term goal of big data analysis, particularly on X, due to the dynamic communication networks produced and the millions of user interactions (Budiana et al., 2024).

Numerous studies have explored the role of social media in crisis communication and natural disaster response. Highlights the significant role social media plays in public engagement and crisis communication policies across various contexts (Elfattah, 2024). However, research that explicitly examines the use of influencers or “digital opinion leaders” in the context of natural disasters remains limited. Models have illustrated the influence of micro-influencers during crises, though primarily within geopolitical conflict settings—not specifically in the context of natural disasters or within Indonesia (Taher et al., 2025).

In the Indonesian context, existing studies tend to focus on official institutions and their use of social media platforms. Examples include the use of Instagram by Jakarta's Regional Disaster Management Agency (BPBD) Badan Penanggulangan Bencana Daerah or Regional Disaster Management Agency Jakarta as discussed by (Hutabarat et al., 2023), and disaster education through social media in coastal communities as examined by (Septian et al., 2024). Yet, few studies have quantitatively assessed the specific role of influencers in disseminating disaster-related information.

This study offers a novel contribution by shedding light on how digital influencers can play a strategic role in disaster communication within Indonesia a context that remains underexplored in current research. Public reactions to disaster information on social media are vigorous because swift responses are essential to minimize casualties. Yet, while the government seems mired in administrative tasks and neglects the emerging information on social media, it appears that fellow citizens care more than their own government. Public opinion on social media, serving as a monitoring tool, can help government agencies detect warnings from the public, identify critical information that affects the government's image, and formulate strategies to respond to emerging societal issues (Sun et al., 2022). Social media has become a space for current public mobilization and will continue to do so in the future, potentially shaping new norms in the way society responds to government policies (Fachlevi et al., 2024).

The objective of the study: 1) to examine the role of digital volunteers in disseminating disaster information on X; 2) to analyze the social network dynamics of digital volunteers on X in addressing gaps left by government agencies in disaster information dissemination. This research focuses on X because X offers data access to the public interested in analyzing opinion using big data. The data examined include X user volume, top influencers, top tweets, the communication network among X users, and sentiment analysis.

While this study highlights the limited presence of government actors in disseminating disaster-related information on Platform X, it is important to clarify that this does not imply a complete absence of governmental activity in the digital sphere. Both national and local government agencies in Indonesia are, in fact, active on other major social media platforms such as Instagram, Facebook, and YouTube, which command significantly larger user bases in the country. The government's relative absence on Platform X is more reflective of the platform's characteristics, which do not align with the primary channels typically used for public communication.

According to the January 2025 DataReportal report, Indonesia has approximately 143 million social media identities representing around 50.2% of the national population with user activity predominantly concentrated on visual platforms like Instagram and TikTok. In contrast, Platform X (formerly Twitter) accounts for roughly 25.2 million users, or 8.8% of the population, placing Indonesia among the top five countries globally in terms of X user base (World Population Review, 2025). These figures suggest that although Platform X is not the government's primary communication medium, it remains a vibrant digital public sphere where digital volunteers and influencers actively disseminate disaster-related information in real time.

Therefore, the aim of this study is not to critique the government's absence, but rather to underscore how the dynamic engagement of digital volunteers on Platform X can serve as a valuable input for government agencies to consider integrating this platform into future national disaster communication strategies.

Currently, the relationship between government institutions and digital volunteers remains sporadic and lacks integration within the national risk communication framework. Yet, international literature emphasizes that cross-sector collaboration is essential for effective communication during emergencies (Kapucu & Garayev, 2011; Kim & George, 2008). To address this, the government should develop more systematic mechanisms for synergy, including digital disaster literacy training, mapping of key local influencers, and leveraging citizen-generated data as an early source of situational awareness to accelerate emergency response (Reuter, 2021). Such strategies can strengthen the model of digital disaster governance an approach that integrates online communication with on-the-ground disaster management systems (Qu et al., 2023).

Grounded in social network analysis theory and disaster management frameworks, this study seeks to understand how digital volunteers help bridge information gaps during natural disasters on Platform X. The research focuses on analyzing communication networks and public sentiment during 1st to 31st May 2025, a period marked by a significant surge in disaster events across Indonesia. Conceptually, this study contributes to the development of a disaster communication model rooted in digital participation, related to the Indonesian context. Practically, it offers concrete policy recommendations, including the integration of digital volunteers into the national risk communication system, the enhancement of government presence on digital platforms, and the formulation of disaster communication policies that are more responsive to the dynamics of social media in the information era.

2. Research Methodology

The selection of X (formerly known as Twitter) as the subject of this research is due to its ability to offer a diverse range of news, comments, and public perspectives compared to other social media platforms (Budiana et al., 2024). Social Network Analysis (SNA) enables researchers to identify key actors, track information patterns, and understand how information spreads through communication networks (Wahyuddin et al., 2024). SNA presents the data of communication networks based on the relationships between nodes and edges (Sitorus, 2022). It can elaborate on social actors within these networks, ranging from individuals and community segments to public service providers and even countries or entire continents (Freitas et al., 2025).

SNA is particularly useful for identifying the hubs of news dissemination and measuring the spread of information among involved communication networks (Aditiawarman et al., 2023). Social media platforms allow every individual to express their opinions without being restricted by the hierarchical consensus that often prevails in society, making the opinions more natural, honest, and impactful (Kristensen, 2020). Social media—including X—serves to disseminate information, bridge the formation of public opinion, and connect diverse public dialogues across various interesting topics (Wibisono, 2023).

This research aims to examine the circulation of natural disaster information by digital volunteers on social media as they fill the gap of formal information that should have been provided by the government. The measurement does not focus solely on the number of X users; it also considers top influencers, top tweets, the communication networks among X users, and sentiment analysis derived from interactions among these users. The sentiment analysis results will reveal the diverse perspectives of the public, influenced by various contexts such as discussion topics and information sources (Pratama et al., 2022). Using X as an analytical tool has become a popular method for gauging public opinion and understanding the relationships within communication networks on social media (Sumartias et al., 2023).

The process of downloading, processing, analyzing, and visualizing the research data is carried out by the researchers using NodeXL software. Data processing occurs in three stages: (1) determining the keywords used to download data; (2) defining the sample; and (3) conducting analysis using three levels of data analysis content analysis, behavioral data analysis, and network structure data analysis (Suratnoaji et al., 2019). Data for this study were collected via the X API using NodeXL software, covering the period from January 1 to May 31, 2025. All data were retrieved using the keywords “bencana” (disaster), “gempa” (earthquake), and “gunung api” (volcano), written in Bahasa Indonesia to ensure relevance to the national context. To maintain local representativeness, language and geolocation filters were applied so that only posts originating from within Indonesia were included, while content from foreign sources was automatically excluded. Additionally, tweets containing commercial or promotional hashtags were removed to preserve the research focus, whereas disaster-related hashtags such as #PrayforBengkulu and #GunungMarapi were retained as indicators of public engagement in disaster communication.

Following data collection, a cleaning process was conducted to eliminate duplicate posts, spam, and automated activity (bots), ensuring that the analysis reflected organic interactions. The cleaned dataset was then analyzed using Social Network Analysis (SNA) to map interaction patterns and identify key actors in disaster information dissemination. Core metrics included degree centrality, betweenness centrality, and closeness centrality, which were used to assess influence, connectivity, and communication reach among users. Network visualizations were generated to illustrate communication

clusters between digital volunteers and institutional government accounts.

Subsequently, content analysis and sentiment analysis were performed on the collected posts. Content analysis was used to classify conversational themes such as information sharing, emotional expression, government criticism, and requests for assistance. Sentiment analysis was conducted using Orange Text Mining software, which categorized each post into one of three sentiment groups: positive, negative, or neutral. This lexicon-based approach was trained on an Indonesian language corpus to ensure contextual accuracy. To enhance reliability, cross-validation was conducted between the outputs of NodeXL and Orange Text Mining, along with manual verification of randomly selected samples to confirm the accuracy of theme and sentiment classification. Inclusion criteria such as the use of Bahasa Indonesia, the defined data collection period, and topical relevance to disaster issues were rigorously applied to ensure the dataset accurately represented Indonesian public discourse on Platform X.

3. Results

This study begins by determining the number of X social media users involved in disseminating disaster information in Indonesia during 1st- 31st May 2025. The number of X users will shape the characteristics of the public opinion that emerges. Then, from these engaged users, it will become clear whether the interactions are dominated by a few accounts or if they consist mainly of retweets and simple sharing.

The resulting communication network will also illustrate the minimal presence of the government in spreading disaster information on social media. The pattern of information dissemination indicates that the spread of disaster-related news is largely supported by individual accounts that are part of the digital volunteer community. In detail, the aspects of the relationships among X users are outlined in the table below.

Table 1. Network of X Users discussing about Disaster Information

No.	Graph Metrics	Value
1.	Graph Type	Directed
2.	Vertices	1.476
3.	Unique Edges	1.383
4.	Edges with Duplicates	774
5.	Total Edges	2.157

In Table 1, it is shown that 1.476 X users are disseminating disaster information. The number of relationships (unique edges) is 1.383, and from these relationships, there have been 774 interactions. These intensive interactions have produced a total communication network (total edges) among X users who are digital volunteers, amounting to 2.157 networks.

These results indicate that many X users voluntarily play their role as digital volunteers in spreading disaster information. Throughout 1st to 31st May 2025, they have continuously interacted and actively exchanged information to disseminate disaster news. The dissemination of disaster information on social media is critical, as it meets the need for a swift response when disasters occur.

The number of posts circulating disaster information on X naturally follows the occurrence of disasters. Although the data does not show significant fluctuations compared to issues like politics or economics, the circulation of disaster information continues steadily on X. The platform serves as a key reference due to its rapid information updates and the fact that most of its users belong to Generations Y and Z, who are already conscious of the importance of sharing disaster news on social media.

As part of the digital volunteer community, these users help keep disaster information viral and trending on X, ensuring that ongoing disaster issues remain a public concern and prompting the government to take immediate action in managing disasters. The voluntary and consistent efforts of X users as digital volunteers in disseminating disaster information can be observed in the graph shown in Figure 1.

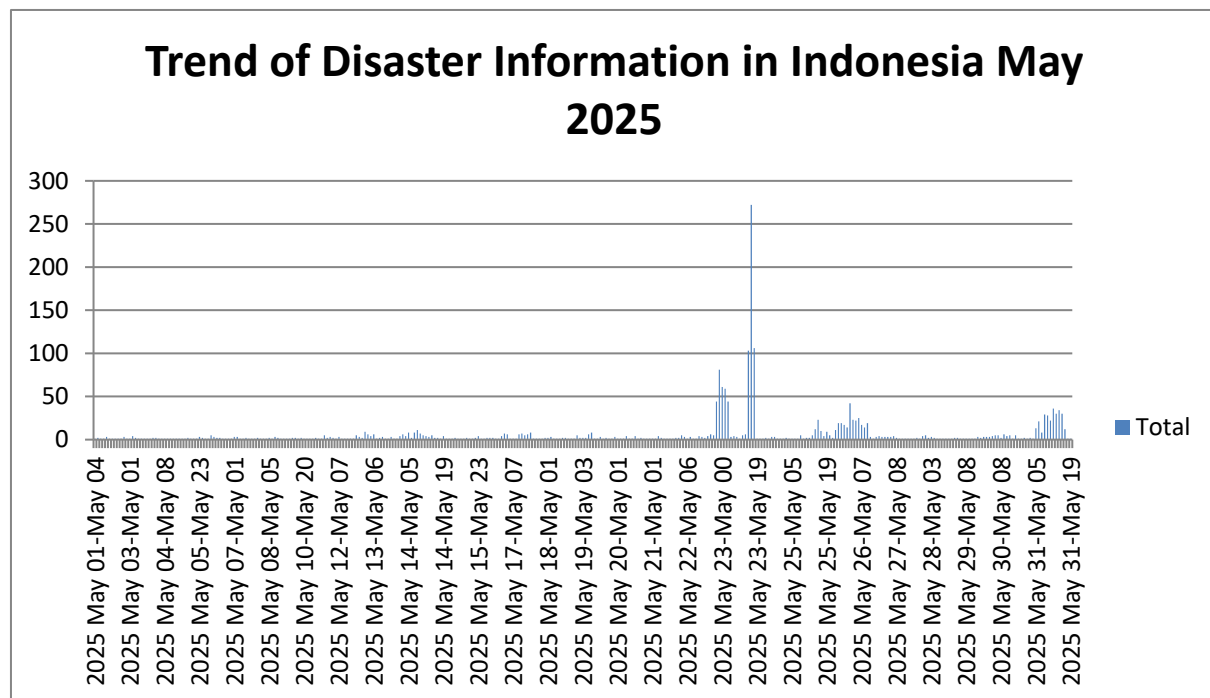


Figure 1. Trend of Disaster Information Response on X

This study measures sentiment analysis of public opinions regarding the dissemination of disaster information on X. The sentiment analysis was conducted using additional software called Orange Text Mining to obtain more detailed results, building upon the primary analysis already generated by NodeXL. This additional tool was necessary due to the limitations of NodeXL, which is only capable of analyzing individual words. By using Orange Text Mining, sentiment analysis is performed on each sentence contained in every post on X. The resulting sentiment analysis regarding the dissemination of disaster information indicates that 16% is positive, 39% is negative, and 45% is neutral. Percentage is as shown in Figure 2:

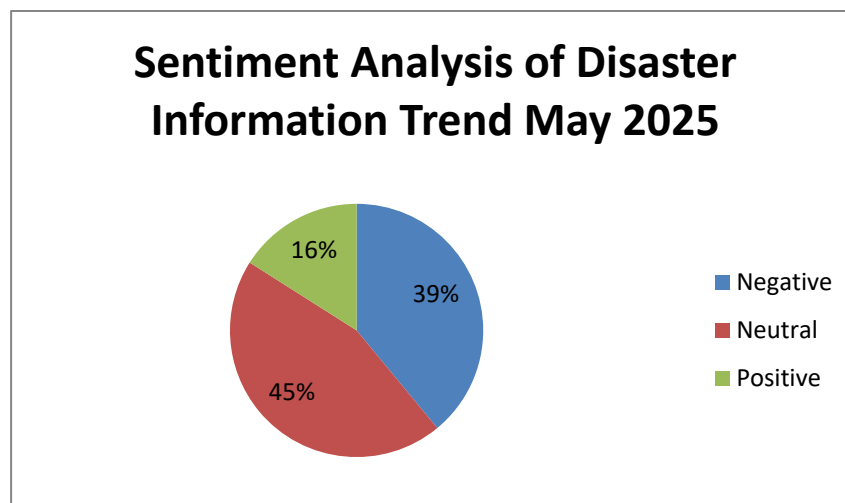


Figure 2. Sentiment Analysis of Disaster Information on X

The formation of public opinion—spanning positive, negative, and neutral sentiments—regarding the dissemination of disaster information originates from discussions carried out by X users acting as digital volunteers. The positive percentage comes from individual accounts of digital volunteers who spread information voluntarily and naturally without any ulterior motives. This positivity is reflected in replies or retweets of posts that report disaster events and lead to constructive exchanges of information. The most frequently occurring positive terms reflect the conditions within disaster-affected areas, with keywords such as “gempa” (earthquake), “erupsi” (eruption), “warga” (residents), and “informasi” (information) emerging prominently. These terms indicate a constructive effort to convey situational awareness and support among users during disaster events. This pattern frequently leads to the emergence of the hashtag #Prayfor, followed by the name of the affected location. The use of this hashtag plays a significant role in sustaining the virality of

disaster-related topics on X, continuously capturing the attention of users and amplifying public engagement.

The neutral percentage indicates that many X users, acting as digital volunteers, disseminate disaster information without adding any commentary. The majority of these digital volunteers focus on sharing information to capture the attention of other users, keep the disaster topic trending, and generate hope for immediate assistance at affected disaster locations. This neutral sentiment is the highest among the sentiment analysis results, underscoring the significant role digital volunteers play in circulating disaster information and responding to disaster events. The most frequently occurring neutral terms include “data,” “trending,” “BMKG” (Badan Meteorologi, Klimatologi, dan Geofisika; Indonesia’s Meteorological, Climatological, and Geophysical Agency), and “Bengkulu” (a region in Indonesia that experienced a volcanic eruption in May 2025). These terms typically serve to convey factual updates, institutional references, and geographic identifiers without expressing emotional bias.

The negative percentage originates from X users who criticize the suboptimal handling of disasters. They continuously provide information regarding various shortcomings experienced in disaster-prone areas, often highlighting the slow response by the government and related stakeholders. The high negative sentiment indicates that public opinion about disaster management is laden with disappointment toward the lack presence of government on X, as other parties are far more active and extensive in disseminating disaster information. The most frequently mentioned negative terms include “rusak” (broken), “serius” (serious), “waspada” (alert), “kuat” (strong), and “dahsyat” (terrible). These words typically convey the severity of the disaster events and reflect heightened public concern, urgency, and emotional intensity in response to the unfolding situations.

The government's lack of presence on X is evident in the top five most discussed posts related to disaster information throughout May 2025. The only government account that appears is **@infoBMKG**, which generates almost no interactions. This X account functions as an Early Warning System (EWS), utilizing an auto-post mechanism similar to a bot; it is designed solely to automatically post-earthquake information when an earthquake occurs. The account does not reply to comments or engage in other interactions. Therefore, although it ranks first as the central source of information dissemination, it is considered non-participatory in the social network analysis because it does not generate interactions among X users. The top five disaster information discussions on X are detailed in Table 2.

Table 2. Top Tweet Disaster Information in Indonesia

Account Name	Translation of Tweet	Number of Responses
@tanyakanrl	Guys how come the earthquake in Bengkulu 6.3 SR is not trending yet? Are you serious?	214
@infoBMKG	Earthquake in West Bengkulu, in the depth of 10 km with 6.3 SR. No potential of tsunami.	49
@urrangawak	Gunung Marapi in Sumatera Barat erupted again on Wednesday, May, 14 th 2025.	47
@detiksumbagsel	The amount of crashed home around 100 houses in Bengkulu. Pray for Bengkulu.	34
@mdy_asmara1701	Earthquake strikes Bengkulu again. 100 houses are crashed.. Pray for Bengkulu.	28

The following section provides a brief description of the accounts responsible for generating top tweets related to disaster information. The account **@tanyakanrl** is an individual-operated profile on X with 3.4 million followers. Its primary purpose is to serve as a discussion hub for the latest developments in Indonesia. The account regularly covers trending topics across social, economic, political, and cultural domains. Due to its rapid response capability, it is frequently cited as a key reference point for real-time discourse in the country.

Meanwhile, **@infoBMKG** is the official account of BMKG (Badan Meteorologi, Klimatologi, dan Geofisika), known internationally as the Indonesian Agency for Meteorological, Climatological, and Geophysics. With 10.2 million followers, this account functions as an Early Warning System (EWS), providing timely updates on earthquakes, extreme weather alerts, and other geophysical hazards. Unlike individual accounts, **@infoBMKG** primarily disseminates factual disaster-related information and does not engage in interactive communication such as replying to or responding to user comments on X.

The third account, **@urrangawak**, is an individual user on X with 34,643 followers. Similar to **@tanyakanrl**, this account focuses on discussions surrounding current issues in Indonesia, although its follower base is relatively moderate in size. The fourth account, **@detiksumbagsel**, is a regional branch of the Indonesian online news portal detik.com, specifically serving the South Sumatra Province. Despite having a small follower count of only 182 users, the account demonstrates high posting speed during the initial stages of disaster events, making it a valuable reference point for users seeking timely disaster updates. The final account, **@mdy_asmara1701**, is also operated by an individual and has a follower base of 289,560 users on X. This account is actively engaged in commenting on trending issues in Indonesia, including disaster-related information.

The account **@tanyakanrl** became the top influencer in the dissemination of disaster information throughout 1st- 31st May 2025 on X. This account is an individual account that actively and voluntarily spreads disaster information, as

evidenced by the processed disaster data. Although the content of the post did not explicitly convey information regarding the stages of disaster response, it generated the highest level of engagement, with a total of 214 user interactions. This post served as the initial trigger for the formation of a communication cluster within the network. Subsequent interactions stemming from this post gradually introduced information related to disaster response efforts, thereby extending the informational flow initiated by the original post.

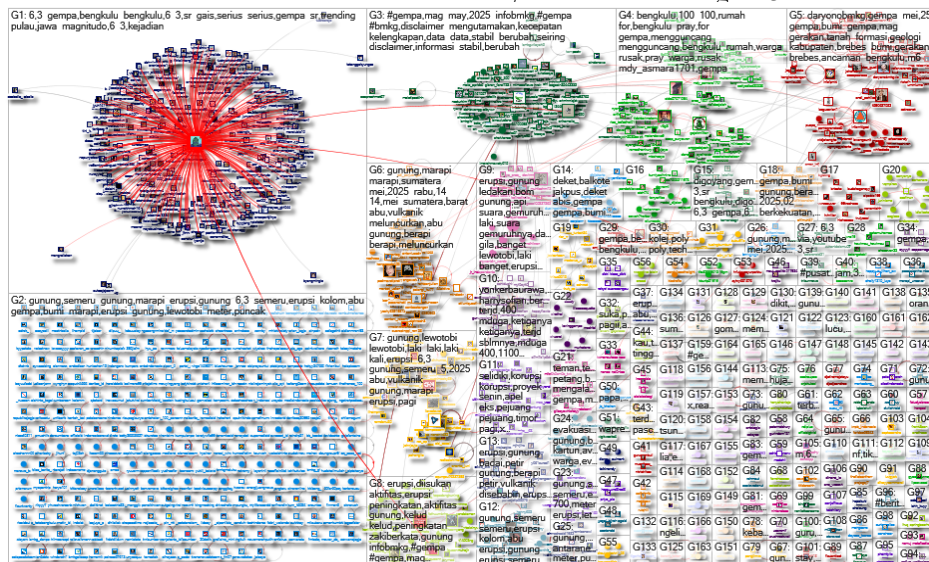
Among the top 10 accounts that disseminate the most disaster information, none of the usernames indicate a government agency. The account **@infoBMKG** is the only government-affiliated account that appears, while the remaining nine are still dominated by individual accounts. These data processing results demonstrate that the role of digital volunteers in disseminating disaster information is indeed very significant, whereas the government is absent. Without digital volunteers, disaster information would not be disseminated widely on social media, and the government should consider this as an evaluation point for future disaster management.

The account **@infoBMKG** is not identified as a top influencer even though it occupies the first position because its nature as an Early Warning System (EWS) relies on an auto-post mechanism for each disaster event that occurs. BMKG also focuses solely on earthquakes, without addressing other disasters such as volcanoes, floods, landslides, and similar events. The interactions it generates are zero since it does not reply to or retweet content from other X users. Thus, the account **@tanyakanrl** is the one that truly disseminates disaster information and interacts with other X users. The top 10 disaster information influencers on X can be seen in Table 3.

Table 3. Top Influencer of Disaster Information on X

No	Top 10 Vertices (Ranked by Betweenness Centrality)	Betweenness Centrality
1	infobmkg	370420.5686
2	tanyakanrl	346497.8056
3	haluqueenn	145815.8842
4	erikamelia__	117024.458
5	mdy_asmara1701	81708.28131
6	padmavatiprati1	79508.11033
7	urrangawak	70565.94161
8	aida57071094	54403.07449
9	primpanda99	53462.29071
10	v3gl	53317.24408

The role of the **@tanyakanrl** account in disseminating disaster information is highly significant, as evidenced by its position as the top influencer and the fact that its posts received 214 responses from other X users. As a digital volunteer, **@tanyakanrl** consistently engages in interactions with other X users by exchanging information on disasters throughout May 2025. The analysis highlights Cluster 1 (G1), located in the upper-left quadrant, as the primary communication hub within the disaster information network in Indonesia during the period of May 1–31, 2025. Within G1, the post by **@tanyakanrl** occupies the central position, serving as the focal point of user interactions on X related to disaster events. Red lines indicate the interaction pathways among users, illustrating the dynamic exchange of information. Communication clusters continued to form progressively, reaching a total of 241 clusters, as detailed in Table 1. These interactions with other X users form a communication network, as illustrated in Figure 3.



4. Discussion

The findings of this study reveal that government presence in disseminating disaster-related information on Platform X remains limited. Platform X is not the primary channel used by government agencies for official communication, the platform's substantial user base in Indonesia ranking among the top five globally underscores its strategic potential as an effective medium for public communication. Government engagement on Platform X should not be viewed as supplementary, but rather as essential to ensuring the rapid, credible, and accessible dissemination of disaster information. While the government is not entirely absent, its communication intensity and interaction patterns remain constrained, particularly in terms of engagement with other users in the digital space (Budiana et al., 2024; Rasyid, 2024).

Network mapping using NodeXL illustrates active interactions among Platform X users, predominantly driven by digital volunteers. The resulting communication patterns reflect spontaneous public responses to disasters, with digital volunteers playing a critical role in accelerating the spread of early information and expanding the reach of disaster-related messages. These activities align with the four phases of disaster management outlined by (Kim & George, 2008): mitigation, preparedness, response, and recovery. During the response phase, digital volunteers are especially vital, as their real-time posts provide immediate situational insights from the field. Such information can expedite decision-making, reduce the need for on-site assessments, and lower operational costs associated with deploying initial government survey teams (Alexander, 2014; Anil et al., 2020).

In this context, enhancing the government's role in initiating and managing public disaster communication on Platform X warrants serious attention. As the entity responsible for public information dissemination, the government must ensure that digital content is accurate and accountable. Government involvement should go beyond one-way communication and foster reciprocal engagement with the public. This approach aims to build public trust, accelerate information flow, and harmonize official and citizen-generated content within a coordinated disaster communication system (Reuter, 2021).

Digital volunteers, in this regard, do not replace the government's role but serve as strategic partners in strengthening disaster communication effectiveness. Through their rapid and widespread activity, digital volunteers act as agenda setters, elevating disaster issues to trending topics on Platform X. This increased visibility aids government agencies in mapping affected areas and gauging public sentiment in real time. Consequently, the data and posts generated by digital volunteers can serve as preliminary information for disaster response agencies to verify on-the-ground conditions and prioritize interventions (Fauziah, 2025; Wahyuddin et al., 2024).

Moreover, collaboration between government entities and digital volunteers has the potential to enhance the effectiveness of the response phase in the disaster management cycle. Information sourced directly from the public through volunteer posts can complement official data, thereby expediting assessments and decision-making processes. User-generated content such as photos, videos, and brief field reports can offer accurate snapshots of affected areas, enabling authorities to plan tactical and efficient relief efforts and coordinate rescue operations more effectively (Yuliana, 2023).

To strengthen this synergy, a collaborative strategy between the government and digital volunteers is essential. First, the government can organize regular digital disaster literacy training for the public, focusing on how to craft accurate and responsible posts on Platform X including caption writing, hashtag usage, and identifying credible sources. Such programs can also help mitigate the spread of misinformation, which often proliferates during disasters (Alexander, 2014). Second, the government can map key accounts or top influencers active in disaster-related discourse. These accounts can serve as local focal points or liaison nodes for coordinating the dissemination of official information in their respective regions (Reuter, 2021). Third, the government can adapt field assessment methods by leveraging the digital footprints generated by volunteers. Real-time visual and textual data can provide early references for relevant agencies to validate conditions and determine aid priorities more swiftly. This strategy is expected to make government actions more tactical, adaptive, and targeted, thereby minimizing casualties and losses.

Overall, the findings of this study affirm that optimizing government presence on Platform X does not entail replacing conventional disaster communication mechanisms. Rather, it involves expanding their reach by integrating organically formed digital communication networks led by volunteers. Synergy between government agencies and digital volunteers will strengthen Indonesia's disaster communication ecosystem, fostering a system that is more responsive, participatory, and adaptive to the dynamics of the digital information era. Such a collaborative approach will enhance risk communication effectiveness, accelerate the dissemination of life-saving information, and build public trust in government-led disaster response efforts (Iqbal et al., 2021).

The sentiment analysis reveals that negative opinions (39%) outweigh positive ones (16%) in digital conversations surrounding disaster events. This indicates a prevailing public dissatisfaction with the government's performance in disaster management. Although neutral sentiment (45%) remains dominant, this condition should not be overlooked, as prolonged neutrality may evolve into broader public distrust. Such distrust poses a serious risk of triggering a public communication crisis, wherein citizens no longer perceive the government as the primary source of information and instead rely entirely on third-party actors. This risk highlights that the government's absence from digital spaces not only undermines state legitimacy but also jeopardizes future disaster coordination efforts. These findings affirm (Sun et al.,

2022) assertion that public opinion on social media serves as a barometer of societal trust in government performance. If left unaddressed, this situation may escalate into a communication breakdown between the government and the public, further eroding institutional credibility and response capacity.

Implications of this study are divided into two primary dimensions. Theoretically, it reinforces the concept of the digital public sphere, highlighting that social media functions not only as a communication tool but also as a participatory arena where citizens engage with disaster-related issues. Practically, the findings offer valuable insights for the Indonesian government in designing a more responsive and participatory disaster communication system. Digital volunteers should be recognized as strategic partners in the dissemination of emergency information, while the utilization of social media big data must be integrated into official disaster management frameworks.

One limitation of this study lies in its data collection period, which was restricted to a single month (1st to 31st May 2025), rendering the public opinion snapshot temporally bound. Future research should extend the timeframe and combine social media data with field observations to achieve a more comprehensive understanding of the effectiveness of disaster information distribution. Accordingly, this study underscores that the presence of digital volunteers and the strategic use of social media big data should be viewed as opportunities for reformulating Indonesia's disaster communication system. The government must reimagine social media not merely as a one-way broadcasting channel, but as an interactive space that enables direct engagement with the public. When effectively integrated, collaboration between government agencies and digital volunteers can foster a disaster communication ecosystem that is more responsive, transparent, and adaptive to public needs.

5. Conclusion

The presence of digital volunteers on platform X plays a critical role in disseminating disaster-related information and responding to emergency events. With Indonesia ranking among the top five countries in terms of X user base, the platform has emerged as a vital channel that warrants formal recognition within the government's public communication strategy. Based on data from the top 10 disaster information influencers in Indonesia during the period of May 1–31, 2025, the most active account in disaster news dissemination was @tanyakanrl, an individual account focused on current issue discussions. Of the ten leading influencer accounts, only one—@infoBMKG—was affiliated with the government. However, its engagement was limited and unidirectional, primarily serving its function as an Early Warning System (EWS). While the government is not entirely absent from the platform, its presence remains minimal and lacks interactive engagement with users in the context of disaster communication. Therefore, it is imperative for the government to consider integrating platform X as a primary source of information in fulfilling its public communication mandate.

The role of digital volunteers is evident through data analysis, which identified the formation of 2,157 communication networks discussing disaster events in Indonesia between May 1–31, 2025. Sentiment analysis revealed that only 16% of user interactions carried a positive tone, while the remainder were neutral or negative. This condition underscores the need for the government to actively engage in disaster-related discourse on platform X to ensure balanced information flow and mitigate the spread of misinformation. Enhancing governmental participation on X can help sustain public trust and improve the proportion of positive sentiment in future analyses.

While digital volunteers do not replace the general public, they have successfully positioned themselves as agenda setters on platform X. Their efforts have propelled disaster-related topics into the trending sphere, thereby assisting the government in mapping real-time conditions in affected areas. Posts generated by digital volunteers on X offer valuable insights that can be leveraged by government agencies during the response phase of disaster management, significantly reducing the time and cost associated with on-site assessments. By utilizing these user-generated updates, the government can implement more adaptive and efficient disaster response strategies.

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Authors contributions

Dr. Rizky Fauziah, with expertise in big data applications for social sciences, and Dr. Rehia Karenina Isabella Barus, a specialist in disaster communication phenomena, collaborated intensively to identify the research gap and formulate the novelty of this study. Dr. Evi Yunita Kurniaty contributed analytical insights from the governmental perspective, emphasizing the need for public institutions to adapt their disaster response strategies to the dynamics of social media. Dr. Nina Angelia, Dr. Beby Masitho Batubara, and Dr. Audia Junita provided detailed elaboration of the discussion points and conclusions, ensuring clarity and depth throughout the manuscript. The collective efforts of all authors were instrumental in completing this research, which offers a meaningful contribution to the advancement of disaster management practices in Indonesia.

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The authors declare that this research was conducted independently and is free from any conflicts of interest. It is not influenced by, nor does it support, the interests of any specific individual, organization, or institution.

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