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Framing of disaster impact in online news media: a case study from Malawi on flood risk management

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Introduction: High-quality impact data is essential for several applications in disaster risk management including Early Warning Systems. Currently, most impact data have spatial and temporal gaps, especially in data-poor contexts. Local news media reporting on disasters can contain information to bridge these gaps. However, each news media outlet frames disasters differently, especially since disasters diffuse in time and space. This study addresses these challenges by interrogating the implications of varying depictions of disasters in media reporting and their added value for impact databases. Our case study focuses on Malawi for two reasons: first, it is a country prone to flooding and second, it is considered a data-poor country.

Methods: Our dataset comprises of news articles from four quality leading national newspapers which were identified through a basic web search and an electronic database search of Malawian news outlets. We compare the impact information from these news articles with the disaster impact data from the international Emergency Events Database (EM-DAT). To comprehensively investigate our dataset, we applied natural language processing (NLP) techniques to break down and interpret news article texts and narratives, such as sentences and parts-of-speech. We worked with three linguistic annotations: part-of-speech tagging, named entity recognition, and sentiment analysis

Results: The main conclusions from our analysis are that: (1) online news media has a human-focus framing – highlighting the role of crucial persons; and (2) online news media frame impact, such as economic consequences, at a granular level, which can help quantify flood damage.

Discussion: We argue that our study has many valuable applications in other disaster-prone countries in the Majority World, given the high penetration of online news and social media. Our study serves as a first step into better understanding the framing of disasters in online newspapers with social media presence to extract impact data and enrich institutional impact databases in a more insightful way. This study can help actors in disaster risk management focus on information from local news media to enrich existing impact data and to define triggers for disaster risk management.

KEYWORDS

climate change, floods, text mining, risk communication, disaster risk management, impact data, NLP

1 Introduction

Access to timely and accurate official information about a potentially destructive hazard is crucial for disaster preparedness. “Official information” is information originating from a perceived authoritative and trustworthy source (Chauhan and Hughes, 2017). People use multiple sources to inform themselves about disasters and nowadays they look for information in online news outlets to get real-time updates about their surroundings (Tanev et al., 2017).

Likewise, accurate information on the impact of past disasters caused by natural hazards¹ (“impact data”) is of paramount importance for disaster risk management applications (van den Homberg et al., 2022). Various research has been conducted to explore whether information from online news can be used to enhance impact data from global databases, given that online news is trusted by society as a reliable source of information. For example, De Brito et al. (2020) showed in a data-rich environment, for example Germany, that media data can be used for rapidly and accurately monitoring the propagation of drought consequences over time and space. Preliminary research has also shown that national and local newspapers in data-poor environments or countries with less accurate information available on disasters tend to cover smaller disasters as compared to the disasters covered in global impact databases (van den Homberg et al., 2022). Hence, information from local news media may increase the quality of these global impact databases.

However, tracking the descriptions of a disaster in online news media is a challenging task on its own because of (1) overlapping descriptions of the same facts but in different newspapers and (2) irrelevant or unreliable content that remains pervasive (Tanev et al., 2017). This study addresses these challenges by interrogating the implications of varying depictions of disasters in media reporting and their added value for impact databases.

We have selected Malawi as a case study. The first reason being that floods, caused by erratic rainfall, pose a threat to the low-lying regions in this country with over 100,000 people affected each year (Government of Malawi, 2019; Hendriks and Boersma, 2019). The agricultural industry is especially affected by floods given that this accounts for 29% of Malawi’s GDP (Šakić Trogrlić, 2019). Food shortages and higher domestic prices related to these floods increases the national poverty headcount rate each year. Second, because it is a data-poor country with a gap in impact data.

Most impact data in Malawi is only available at an aggregated spatial level and data for major cities was limited. Temporal coverage varied significantly across the three databases. Among the databases that we used in this research (described in detail in section 3), but also within one database, there were variations in terms of the number of indicators that impact was reported on. In general, impact data on physical damage was more complete than on, for example, health and livelihoods (UNDRR, 2023). Therefore,

we consider the extraction of impact data from local sources to enhance their state-of-the-art impact databases as a promising approach for Malawi’s disaster management and risk reductions strategies.

We explored the complexity of portraying disasters in online news media through our guiding question: *how are flood events presented and framed in online news media?*

In the context of our research, “framing” is discussed down to the actors/entities and tone of voice covered in the news about flood events. To that end, we ask the following sub-questions:

- Which entities are emphasized in the news coverage of flood events and by which newspapers?
- How does the online media tone flood events?

News media can frame certain events that affect the adaptation practices of vulnerable populations (Bohensky and Leitch, 2014) and government actions (Norris et al., 2008), while using a certain tone of voice. Framing refers to the process of creating frames; simplified and interpretive versions of reality that rely on perception and sense-making (Bogdan et al., 2020). Or, put more simply and in the context of news media, it refers to which information is presented and how it is structured within a story. Next to the framing, it is also important how the story is delivered, with which emotional quality or tone. Understanding these framing patterns and tone of voice is crucial because “such hazards diffuse in time and space and are therefore particularly open to competing definitions of problems and solutions” (Sonnett et al., 2006, p. 95). This article contributes to the scholarship on crisis media reporting and deconstructing media framing and tone of voice during critical periods such as disasters. This study could help actors in disaster risk management understand how obtaining information from local news media can enrich existing impact data. Moreover, our study can help citizens of disaster-prone countries increase their understanding of any impending impact from a forthcoming hazard.

2 Media and the environment

Framing, tone of voice, and entities are crucial elements in shaping how an audience perceives a story. These three elements are highly intertwined, although they function in different ways. First, we will explain framing in general and framing in the context of a disaster. Second, we will introduce the concept of tone of voice in combination with entities.

Framing may be an individual decision-making process taken by journalists, but it is also an organizational product, process, and political-strategic tool (Entman et al., 2009). Existing work tells us that the news media’s emphasis on certain elements and considerations of an issue give them the authorization to shape, interpret, and legitimize existing political dynamics and economic and power relations in the environmental discourse (Fry, 2003; Parida et al., 2021). Framing theory holds that a specific selection of words or perspectives matters because it leads and reorients readers to construct and derive different meanings about an issue. What is particularly vexing in framing is the phenomenon known as “framing effects” (Chong and Druckman, 2007). These effects occur when small changes in the presentation of an issue or event produce significant differences of opinion.

¹ Disaster studies are brimming with examples that show a disaster does not happen unless people are vulnerable due to inequitable access to resources, knowledge, and support (Chmutina and Von Meding, 2019; Kelman et al., 2016). These vulnerabilities are then heightened by natural hazards such as floods, typhoons, and droughts. Thus, it is a misnomer to refer to these hazards as natural disasters because they are not at all natural.

TABLE 1 Flood events in 2018 and 2019 (EM-DAT, 2022).¹

Year	Type	Origin	Start date	End date	Persons affected	Top districts
2018	Flash	Heavy rain	1 February	14 February	300	Salima, Nkhotakota
2018	Flash	Heavy rain	22 February	7 March	200	Chikwawa, Lilongwe
2018	Flash	Heavy rain	11 April	17 April	9,113	Nkhotakota, Salima
2019	Flash	Heavy rain	1 January	31 January	15,974	Chikwawa, Lilongwe
2019	River	“Idai”	4 March	10 March	975,672	Machinga, Chikwawa

¹Appendix A lists the full DoDMA flood records and total households affected by district. This has also been used as reference for comparing flood events in databases and newspapers.

Framing can be both an individual decision-making process for journalists and a collective product, process, and political-strategic tool within an organization. The media's focus on a particular aspect of an issue can potentially lead to emphasizing one dominant public interest, and, crucially, selective policy outcomes. In this way, the news media act as cultural agents empowered to shape, interpret, and legitimize political, economic, and power dynamics within environmental discussions. In addition, media has limited carrying capacity or, in other words, the amount of information it can carry through its channels (Hilgartner and Bosk, 1988) which influences the framing. The quality of news reporting on a certain event is influenced by the number of events that occur in concurrence. As a result, media coverage may strive for novelty and newsworthiness that often occurs closer to a disaster or extreme event. In that way, media might fail to have a direct role in risk communication and behavior change if it chooses to focus on newsworthiness (Parida et al., 2021).

Next, to the framing and the selection of the direction and context of a story, media can also decide on a certain tone of voice. Media reporting can be biased especially if emotionally charged language is used to sway attention away from facts to emotion-provoking narratives (Iyengar, 1991). Biased media reporting can influence public opinion to put less weight on policy-oriented substantive matters such as disasters (Parida et al., 2021). In addition, Gortner and Pennebaker (2003) found that the tone of voice in the early days of a disaster is rich in emotion but becomes more “distanced” as time passes. Parida et al. (2021) found that 85% of news coverage surrounding Cyclone Amphan was “neutral” wherein positive or negative tones were not dominant in the news coverage. Moreover, they note that the media was mainly engaged in showing the technical or informational side of the cyclonic event. When it comes to reporting on the experiences, only a small proportion of articles were coded as negative despite a disaster being considered a tragic event.

However, the pressure to create content can influence media organizations to create content in less time and with fewer resources which can pose a problem to the credibility of the news. When, in this context, there is a high reliance on only a handful of entities dominant views on the disaster can be the result. Entities refers to the key organizations (or individuals) that are represented in a story. When it comes to the actors in environmental news coverage, both the individual's perspective as the institutional views is present in the reporting. For example, Houston et al. (2012) found that individuals are the most frequent entity in disaster stories that describe the concrete impact on people. Barnes et al. (2008), on the other hand, found that media reporting emphasized government response over individuals' and communities' level of preparedness or responsibility during Hurricane Katrina. In covering the relation between the individual level and the governmental level in disaster news stories the media are interested in

the political and economic perceptions of the individuals involved rather than in their concrete experiences (Franks, 2006; Joye, 2009).

In the end, environmental and humanitarian issues are complex, with constantly evolving facts. Many forces influence how an event is portrayed such as the combination of framing, tone of voice, and choice of entity perspective. Thus, the social and cultural situatedness of disaster reporting is inevitable.

3 Materials and methods

3.1 Floods in Malawi

Malawi, a landlocked country in south-eastern Africa, covers an area of 118,484 km² and is one of the most flood-prone countries in the world (Miles and Moorse, 2007). Malawi is divided into 28 districts across three regions. The Lower Shire Valley extending southwards to Mozambique hosts the Chikwawa and Nsanje Districts, where floods continue to stifle the daily lives of Malawi's inhabitants. Floods caused by erratic rainfall threaten these low-lying regions, with over 100,000 people affected each year (Government of Malawi, 2019).

We relied on the Emergency Events Database (EM-DAT) (CRED, 2022) and the Department of Disaster Management Affairs (DoDMA) in Malawi as official sources for recorded floods. These are widely used disaster databases that attempt to aggregate and classify data to support the analysis of the types and effects of the disasters recorded (Osuteye et al., 2017). In particular, we built on a gap analysis conducted for UNDRR, which compared impact data from DesInventar,² EM-DAT³ and the Department of Disaster Management Office (DoDMA) in terms of indicator, temporal and spatial coverage. The EM-DAT is a comprehensive global database that tracks the occurrence and impacts of natural and technological disasters since 1988. It is maintained by the Centre for Research on the Epidemiology of Disasters (CRED) and provides detailed data on the hazard and several impact indicators. EM-DAT inclusion criteria are at least 10 deaths (including dead and missing), at least 100 affected (people affected, injured, or homeless), a call for international assistance or an emergency declaration.

Malawi experienced extreme flood events in 2018 and 2019, as recorded by EM-DAT and DoDMA (Table 1). January to April are suitable months to analyze how these floods are framed in both years. This time frame allowed for a diversification of articles, including those covering the early stages of the flood, to those reporting on the

² www.desinventar.net

³ www.emdat.be

aftermath days after the event. Finally, two subtypes of floods emerged from our initial investigation: flash floods and river floods. Flash floods arise within small catchments with steep slopes, while river floods usually occur after long-lasting rainfall within large catchments and result in rising water levels (Laudan et al., 2020).

3.2 Official online news sources

Quality newspapers were identified through a basic web search and an electronic database search (ABYZ News Links) of Malawian news outlets. Four national newspapers (Malawi 24, MW Nation, MW Times, Nyasa Times) and one news agency (Zodiak) were used in the study as the leading news outlets for analysis. Articles chosen were also in English as this is one of the main languages used in Malawi. However, our final dataset consisted of articles from the four national newspapers because articles from Zodiak were no longer accessible.

We also identified the Twitter accounts that belonged to each official newspaper and news agency and decided only to include those newspapers with an online and a Twitter presence⁴. Our reasoning behind this decision is that if a newspaper's website and social media pages could not be reasonably found via basic web search using typical search engines, it was unlikely to have served as a reliable and useful source of official information surrounding such flood events (Chauhan and Hughes, 2017). We found that the resulting Malawian newspapers and agencies tend to post or update their news articles daily both on their webpage, and on Twitter.

Tweets from these official information sources during our chosen timeline were retrieved using the twarc⁵ API. Specific search flood keywords from the text body of these tweets were adapted from a disaster keywords list developed by one of the authors⁶. Tweets with keywords such as “flood,” “flash,” or “emergency” were included in the dataset and further examined in an attempt to mitigate the search from providing irrelevant results. The relevant news articles concerning the flood events were extracted from URLs found in tweets, downloaded, and stored as plain text documents for analysis. Articles that made minimal reference to flood events (for example, obituaries, indexes, and news briefs) were excluded from the sample. After data cleaning and filtering, 142 articles conform our final dataset (see Figure 1).

3.3 News articles analysis

To comprehensively investigate our dataset, we utilized natural language processing (NLP) techniques. We applied NLP techniques to break down and interpret the news article text, such as the sentences, words, and even part of speech. We first removed

stopwords, punctuation, and symbols (for example, @, #) that are not relevant for the analysis. The keywords, key entities, and tone were retrieved from these articles using spaCy (Honribal and Montani, 2017). To get insights into the articles' grammatical structure, we worked with three linguistic annotations: part-of-speech tagging,⁷ named entity recognition,⁸ and sentiment analysis.

We identified keywords in the articles using tokenization and part of speech tags and dependencies. In the context of this study, we call keywords the words extracted by Part of Speech (POS) tagging. Specifically, proper nouns, adjectives, and nouns. We excluded verbs because, although they describe actions, they typically serve more grammatical functions and may contain less ideological significance in certain contexts. Our study examines framing of disasters in digital media: how media portrays actors, roles, ideologies, and beliefs during disaster events. Nouns and adjectives establish critical characterizations, for example, labeling someone a “flood victim” versus a “flood survivor” can reveal underlying framing.

Identifying these words can demonstrate how floods are described and which words are usually associated with these events to recommend which relevant keywords are helpful when scraping disaster information. POS tagging helped us analyze entity representation in flood disaster news coverage, identify which specific entities (people, organizations, locations) receive prominence in the articles, and how these actors are characterized in reporting. We do not explicitly detail the specific POS tags in this paper. However, they are fundamental to our interpretation of the entities identified using Named Entity Recognition and their roles in the media narrative.

Named entity recognition (NER) recognizes “real-world objects” assigned with a name – for example, a person, country, product, or number. We can infer from these named entities which the local media considers appropriate, their roles in the events, and why they are underlined during such disasters. Findings from this method will also help to see which areas are mostly affected by flood events in news outlets and including these data to improve existing databases that may overlook some of these areas especially the smaller locations.

For Named Entity Recognition (NER), we use spaCy's Entity Recognizer with the en_core_web_sm model. We do not fine-tune the model for this analysis due to insufficient articles for adequate training on Malawian natural disasters coverage context-specific entities. Although not fine-tuned, the en_core_web_sm model provides an appropriate balance of processing efficiency and accuracy for our exploratory analysis. It allowed for rapid processing while still capturing essential entities such as people, organizations, and locations in the news articles. Since we looked to gain initial insights into Malawian news media flood coverage in the English language—a context not so extensively studied outside the country—this approach offered the necessary foundation for our analysis. For more granular entity distinction or context-sensitive semantic analysis, a larger, fine-tuned model would be more suitable.

⁴ Twitter was our preferred choice due to the availability and easier access to the data via the Twitter API.

⁵ For more information on twarc API: <https://twarc-project.readthedocs.io/en/latest/>

⁶ List of disaster keywords: https://github.com/rodekruijs/text_mining/blob/master/scrape_newspapers/keywords/Disaster_en.txt

⁷ Appendix B describes in detail how part of speech tagging is done through spaCy.

⁸ Appendix C explains named entity recognition in detail and an example is provided how this is visualized.

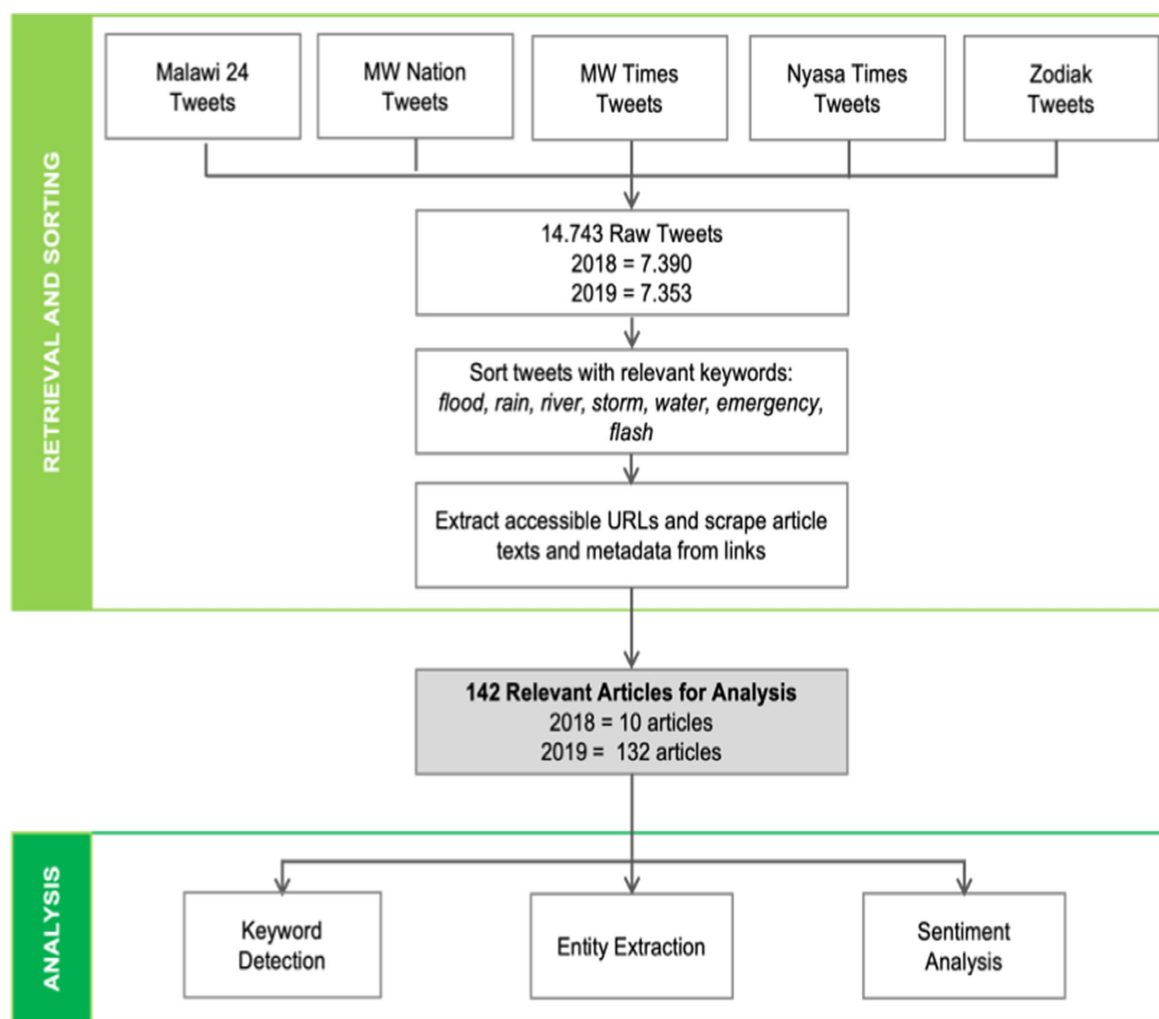


FIGURE 1
Data retrieval, sorting, and analysis process.

Finally, we performed sentiment analysis using `spacytextblob`. A `TextBlob` sentiment analysis pipeline component for `spaCy`. In particular, we extracted the polarity and subjectivity used to identify and categorize the opinions stated in the articles, which can be used to capture the attitude of the writer toward a particular topic (García et al., 2012; Kirilenko et al., 2018). We obtained the articles' polarity (positive or negative) and subjectivity (objective or subjective). The polarity score is a float within the range of -1.0 (negative) to 1.0 (positive), while the subjectivity is a float within the scope of 0.0 (very objective) to 1.0 (very subjective). Words or phrases that typically express opinions, personal feelings, judgments, or beliefs receive higher subjectivity scores, while factual statements receive lower scores. Although the automatic detection of sentiment is not 100 % reliable as emotions are inherently human, the scores provided us with preliminary results that hint at the credibility of these newspapers as another source of local information.

Throughout the paper, we will refer to sentiment as tone; particularly when discussing our findings. Tone is more commonly understood in news media analysis, while Sentiment Analysis refers

more to the specific computational technique. In our context, tone is assessed through sentiment analysis.

4 Findings on Malawian flood coverage

4.1 Meta-data analysis

A total of 132 articles⁹ were identified as relevant for our analysis, all with headings and subheadings about flood events in 2019. The final dataset did not include events in 2018 since we were only able to retrieve a total of 10 articles which were still divided across three flood events. We did not see this as a viable comparison with the number of articles for 2019. Nyasa Times top the number of articles published

⁹ Appendix D shows the full list of the articles, their headings, and date published.

($n = 94$) followed by Malawi 24 ($n = 26$), MW Times ($n = 7$), and MW Nation ($n = 5$).

The articles cover technical information about the flood events. The articles collected also displayed a variety of dates per flood type. The earliest articles pertaining to the flash flood ($n = 27$) were retrieved on January 11 (Table 2). As for the river flood, 105 articles were about the river flood from March 4 to 10, 2019. However, the topics on the actual flood only came out on March 8—4 days after the recorded start date by EM-DAT—hinting these floods are the effects of heavy rainfall.

4.2 Top entities in focus during floods

The next stage of analysis of the articles involved exploring their reporting on the information units or entities, such as names of people, organizations, facilities, events, and locations. We aimed to uncover viable information on which entities were mostly emphasized and relevant during the flood events, which can be applied to effective disaster preparation and response.

Locations ($n = 766$) such as geopolitical entities (GPE) and non-geopolitical entities such as mountain ranges and bodies of water are the top entities covered in the flood news articles in 2019. The next category of top entities are organizations ($n = 675$) followed by persons ($n = 488$). These top three categories of entities complement the findings for keywords and frames where they focus on the news articles on human aspects or the impact of the disaster. We also observe that these top categories are consistent across flood types (Table 3).

Zooming in on the locations mentioned in the news articles, we found that the areas highlighted are mainly at the district level with occasional references to the Traditional Authority areas but rarely at the city level. This is with an exception for Lilongwe, where they focus more on the city than the district, perhaps because this is Malawi's capital city and district. Most of the districts mentioned in the flash and river floods are located in the Southern region near the Shire River. Generally, they report on these locations in a way that they provide information on which areas are most stricken with floods (Figures 2, 3).

The stories surrounding these locations also showcase the human impact of the disaster. Organizations mentioned in the news are observed to be divided into three categories: (1) official authorities on disaster and meteorological services, (2) political organizations, and (3) aid organizations. DoDMA is the top organization that is frequently mentioned in the news. They mention DoDMA for one reason: it is the main source of information. DoDMA is used as a

source to provide metrics on the people affected, information on rainfall and floods, and even to confirm warnings on the incoming hazards.

Political organizations such as the Malawi Congress Party (MCP) and UTM Party are mostly underscored in the news articles. Table 4 below summarizes the organizations mentioned in the news along with the types of these organizations.

As described in Table 4, MCP is a political party founded in 1959 while UTM was recently established in 2018. The country's current president, Lazarus Chakwera, and the vice president, Saulos Chilima, are the current leaders of MCP and UTM, respectively. They are also mentioned quite frequently in the news but not as frequently as the parties they represent. Most news reports about UTM and MCP are primarily on donations and rebuilding initiatives for people affected by the flood. These reports are also written in a positive light. However, MCP also received negative backlash from other parties (DPP) in the news because of how they handled the disaster. International organizations (World Vision, Red Cross, Habitat for Humanity) and local organizations (Malawi Red Cross) also top the list of organizations referred to in news articles. These organizations execute relief operations for affected areas and people and receive donations instead of providing them. They provide appeals to governments and people to help with the relief activities for the affected areas. Each of these organizations has its routines and interests (for example, promotion of activities and funding opportunities) that may inform how they are presented in disaster news (Figure 4).

Similarly, most of the individuals mentioned in the news are Malawian politicians such as Nicholas Dausi, Peter Mutharika, Lazarus Chakwera, and Sidik Mia. News articles report on their statements regarding the floods and action to be done by their political party. Finally, flood victims are also mentioned in the news, although less frequently. They are mostly reported negatively because they are seen as victims of the floods and stories about them revolve mainly around the challenges the floods brought to their lives. The reports surrounding these people show the direct human impact and incidents resulting from the floods.

4.3 Sentiments surrounding the flood events

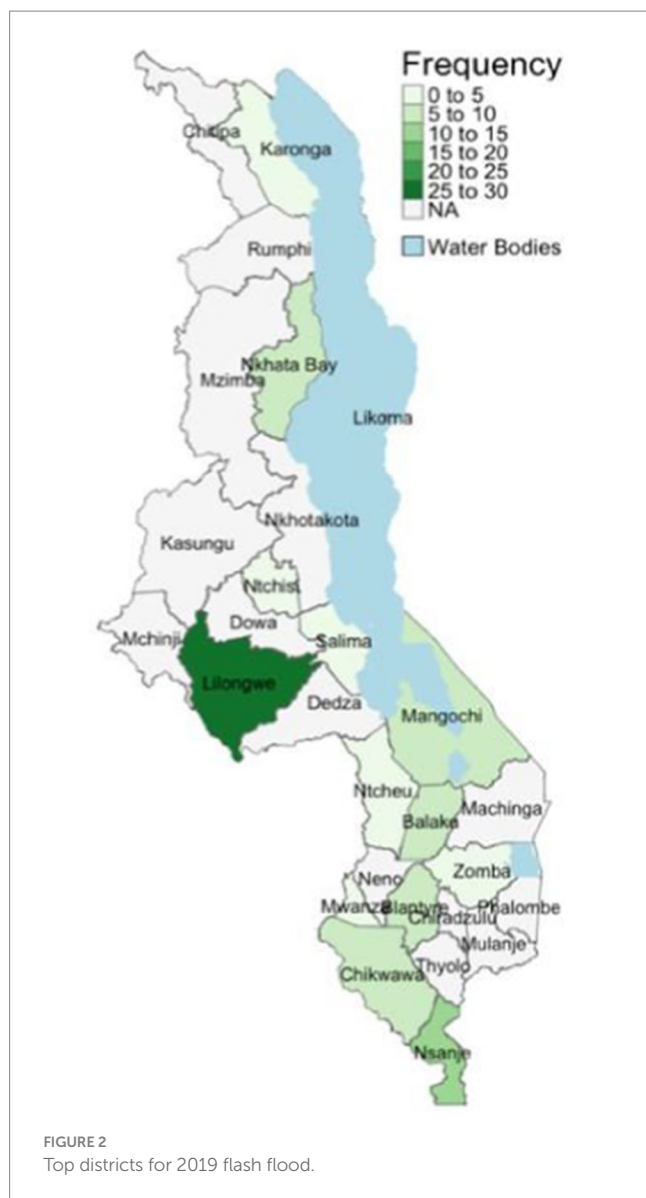
Nearly 65% of articles (polarity = 0.03) had a neutral tone when writing about flood events. This observation could be different if the

TABLE 2 News articles distributed across dates.

Flood type	Start date	End date	# of articles	Earliest article	Latest article
Flash flood	01 January	31 January	27	11 January	19 February
River flood	04 March	10 March	105	08 March	29 April

TABLE 3 Total frequency of entity labels across newspapers.

Flood type	Events	Facility	Location	Group	Organization	Person
Overall	30	53	782	91	630	491
Flash flood	–	14	112	7	86	71
River flood	30	39	670	84	544	420



tone is observed in longer period of time. Moreover, the mean subjectivity flood (subjectivity = 0.40) showed that journalists objectively frame flood events. In the absence of explicit conflicts or contradicting viewpoints, newspapers mainly portray the technical or informational side of flood events where they only describe facts.

Among the newspapers, MW Nation (polarity = -0.03; subjectivity = 0.37) frames the event in a mostly negative tone, while there are no significant newspapers with positive tones given the nature of the impact of these floods. Comparing the two flood types, articles surrounding flash floods (polarity = -0.003; subjectivity = 0.43) report them in a negative tone. The inclination for negativity can be due to how they report on the negative consequences of the floods. Moreover, positive articles are easy to tag because Nyasa Times, which has the majority share of news articles, use the line “Sharing is caring” when there is a donation or aid included in the article. Perhaps this is also helpful to their own categorization of articles. On the other hand, the river flood (polarity = 0.04; subjectivity = 0.39) was mostly neutral in both polarity and subjectivity (Table 5).

5 Discussion

Reporting on two flood events during 2019 in Malawi shed light on humanitarian organizations’ challenges when they make decisions on tracking descriptions of disasters in online news media. Our main research question was: how are flood events presented and framed in online media? We looked at this by deep diving into the entities emphasized in the articles and the tone of the media when reporting on these flood events.

Our findings build upon the scholarly endeavors of Chauhan and Hughes (2017), Fraser and Fitchett (2022), Kuttischreuter et al. (2011), Parida et al. (2021), and Tanev et al. (2017) by providing more specificity of the role of news media in providing disaster information in the Malawian context. Our analysis shows that an indispensable diversion of our study from de Vries (2004) shows that Malawian articles did not only express economic consequences in terms of property damages but also crop and livestock losses.

TABLE 4 Total frequency of entity labels across newspapers.

Organization name	Type of organization
Malawi Congress Party (MCP)	Local political organization
United Transformation Movement Party (UTM)	Local political organization
Democratic Progressive Party (DPP)	Local political organization
World Vision	International humanitarian organization
Red Cross	International humanitarian organization
Habitat for Humanity	International humanitarian organization
Malawi Red Cross	Local humanitarian organization

TABLE 5 Polarity and subjectivity per newspaper.

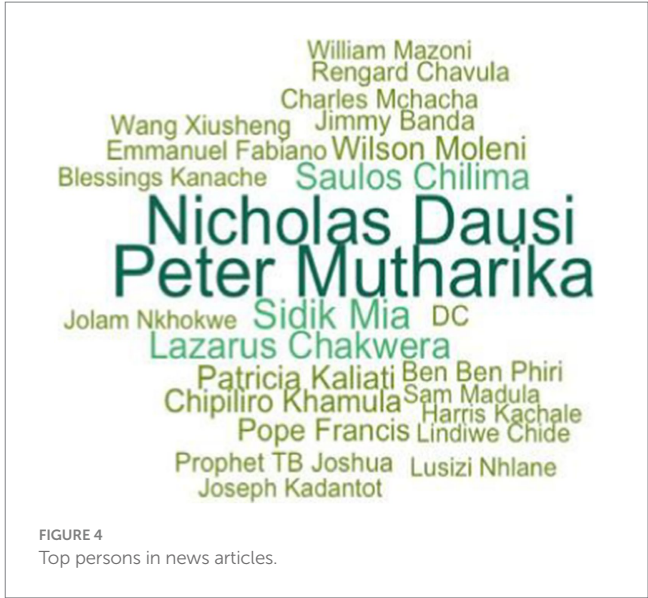
Newspaper	Polarity	Subjectivity
Malawi 24	0.03	0.40
Nyasa Times	0.04	0.40
MW Nation	−0.03	0.37
MW Times	0.06	0.45

This hints more at the context particularity of countries that rely on agriculture as a main source of livelihood and how the media reports what is deemed relevant and vital to the country’s inhabitants.

Apart from the differences in the number of articles covering a flood type, there were no significant framing differences between the two types of floods. This finding is expected as these floods are usually not distinguished from each other in media reporting where they only call these “floods” and have sporadic references to “flash floods.” Our study follows previous studies that have reported that individual or community impact is included in almost all disaster stories (Barnes et al., 2008; Houston et al., 2012). First-level analysis of entities in the articles showed that locations, organizations, and persons were frequently mentioned when reporting on floods. Peter Mutharika and his political party, Malawi Congress Party, were among the top persons and organizations mentioned in the news despite not being affected by the floods. High-profile locations such as Lilongwe were underlined more than other areas, with more people affected by these districts (for example, Chikwawa and Nsanje). There is, therefore, an emphasis on the perceived political and economic importance and not on the level of suffering, when mentioning entities surrounding the disasters (Franks, 2006; Joye, 2009).

The Department of Disaster Management Affairs was considered an official source by journalists, which confirms the findings of Boyce (2007), Dunwoody (2015), and Hansen (1991). This finding implies that bureaucratic structures may dominate disaster policy and practice at all levels with less space for individual expertise. This leads to more credible sources of information in times of crisis but may include the potential for bias in news reporting around disasters because of the perception that other experts may not be easily accessible.

The data we collected unveiled that, on average, the tone of voice was neutral when presenting flood events. This neutrality is more likely linked to presenting facts rather than staying neutral on political issues. Another reason is that the machine evaluation of sentiment shows averages based on the sentiments of words used. Nonetheless,



this general finding disputes Gortner and Pennebaker’s (2003) research that reporting was rich in emotion but grew intellectualized as time passed. Only a small proportion of articles were seen as negative and more present in the flash floods. Negative articles may also exaggerate disaster information and may be seen as unreliable. These negative articles also involve disputes between political organizations and actors (for example, government) perceived to be responsible for the disasters, which Kuttschreuter et al. (2011) also report in their study.

Our research anchored on Malawian flood coverage allowed for rich empirical insight into the promises of retrieving disaster information and the role this could play in different DRM application domains. Moving forward, we address our limitations and call for more work to gain further insights on how we can replicate this approach to other contexts and other online sources. First, we only screened articles from January to April 2020 around the two flood events recorded by EM-DAT. Some articles that may have been published weeks and months after this period may have been missed. Further work in this direction is to have a longitudinal study covering a more extensive database of articles, including the 2015 floods – a remarkable period for the disaster management policies in Malawi. We can reveal trends and misinformation (Fraser and Fitchett, 2022) from articles framing and how this has changed over time. In relation to content, future research can also focus on disaster management related issues such as risk and situational awareness, vulnerability assessment and impact.

Second, there may have been newspapers covering floods in Chichewa with more local neighborhood-scaled narratives of hazards, such as terminologies for floods and heavy rains in their language. Further research can include local newspapers in the local language or even comments in the news articles in Chichewa. A related limitation is that the methods we have used, mainly the named entity recognitions show that the trained data cannot categorize Malawian names and locations perfectly and require manual coding. Machine learning algorithms must consider training these models in different contexts further to activate the use of automated natural language processing. Our study has provided a strong base and a dataset with Malawian context for English articles which can aid in multi-lingual publications for future investigation.

Third, we only focused on national newspapers in our study. Future research may look into analyzing community-level or event-based resources, such as the study of [Chauhan and Hughes \(2017\)](#), to include specific sources for these flood events. We can further find more granular and localized disaster information that can be compared with the data from institutional database (EM-DAT) to understand better how it can add value to such databases.

6 Conclusion

We sought to answer how flood events are presented and framed in the Malawian media to probe the implications of how two floods are described in online news on improving global impact databases. Analysis of 132 news articles through Natural Language Processing (NLP) techniques unearthed the framing patterns that contribute to the diffusion of how these flood events are interpreted, defined, and solved.

Our answer entails two elements: (1) online media has a human-focus framing when reporting on the dramatic events in Malawi, emphasizing the role of crucial persons and actors; and (2) online media frame impact, such as economic consequences, at a granular level, which can help quantify flood damage.

Our study serves as a first step into better understanding of the framing of disasters in newspapers to extract impact data and enrich institutional impact databases subsequently. This study could help actors in disaster risk management to focus on official information from local news media to enrich existing impact data and to better define triggers for disaster risk management.

7 Limitations

Our research presents a novel approach to analyzing flood disaster framing in Malawian media, offering valuable insights for disaster risk management. While our methodology yielded robust findings, we acknowledge several constraints that present opportunities for future research refinement. These limitations do not diminish the value of our findings but rather highlight pathways for methodological advancement in this emerging field of computational disaster communication analysis.

Sentiment analysis in flood media coverage

- The standard sentiment analysis tools used in our study are not fine-tuned for Malawian English usage patterns, local expressions, or culturally specific ways of describing disasters.
- Flood reporting often contains technical language about water levels, meteorological data, and infrastructure damage that might be incorrectly classified as neutral when the intended tone could be alarming.
- Using textblob for subjectivity analysis has limitations, particularly for domain-specific text like flood reporting, since it depends on a general-purpose lexicon that may not always capture the complex ways objectivity and subjectivity manifest in specialized journalism.

Named entity recognition constraints

- The `en_core_web_sm` model used for NER was not fine-tuned for Malawian contexts, resulting in potential misclassification of

local place names, organizations, and person names that have culturally specific forms or origins.

- Lack of contextual understanding in NER models leads to potential misclassification of entities with multiple meanings or roles, for example, a person who is both a politician and flood victim might only be recognized in their political capacity.

Keyword extraction methodology

- The keyword extraction process that we used, did not account for compound concepts that span multiple word types but together form important disaster terminology specific to the Malawian context.
- Without a domain-specific ontology for flood disasters in Malawi, our keyword extraction may have failed to properly weight terms based on their significance in local disaster discourse.

Dataset and sampling limitations

- Our temporal limitation to January–April 2019 excludes longer-term framing shifts that might occur in the extended aftermath of disasters and recovery periods.
- The exclusion of Chichewa-language articles creates a notable gap in understanding how framing might differ in communications targeted to different linguistic populations within Malawi.

Data availability statement

The original contributions presented in the study are included in the article/[Supplementary material](#), further inquiries can be directed to the corresponding author.

Author contributions

HB: Writing – original draft. KB: Writing – review & editing. CO-R: Writing – review & editing. MH: Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Generative AI statement

The authors declare that no Gen AI was used in the creation of this manuscript.

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Supplementary material

The Supplementary material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fcomm.2025.1519357/full#supplementary-material>

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