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Overlooking the victims: Civic engagement on Twitter during Indonesia's 2019 fire and haze disaster

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ABSTRACT

Social media serves as a powerful communication medium, in which researchers and practitioners continue to explore its relevance for understanding disasters. Twitter has received attention for its ability to communicate quickly across space, in support of disaster response, directing resources, and supporting victims. It also highlights what society prioritizes in a disaster. Our research examines the role that Twitter plays during a disaster, with attention on civic engagement among netizens. Indonesia's reoccurring fires are a result of significant land use change taking place across lowland, carbon-rich peatlands in Sumatra and Kalimantan, creating a thick haze that can travel long distances impacting human health, the economy, and greenhouse gas emissions. Foregrounded by critical data studies, we apply a civic engagement framework and conduct big data mapping using Drone Emprit Academic Open Data software by keywording 'forest fires' [kebakaran hutan], aggregating 316,782 tweets unfolding during the height of the fires on 8–21 September 2019. Results show the highly politicized dynamics of this disaster during a period of contentious political campaigning intent on assigning blame or defending actions. In addition, the geography of Twitter users and the rural site of disaster served to amplify politics at scale, while drowning out the needs of direct victims. Thus, although Twitter may have a major role to play in disaster management, it is important to situate its role in the context of the disaster, foregrounding the geographic and political dimensions around the key questions about who is affected and how.

1. Introduction

Social media serves as the new public space, bringing together more and more nodes of discourse. Many envision its potential to unlock democratic opportunities, providing access to anybody with a device and an internet connection. It has become the modern petition, the platform for shaping broader public opinion, and can mobilize a social movement [1], or conversely, can amplify the politics of rumor to distract from culpability and redirect blame [2].

Moreover, individuals and institutions are increasingly compelled to shape narratives on social media, while government agencies increasingly feel the need to participate in shaping and reacting to discourses, communicating their commitments, and also viewing social media platforms for its opportunities in improving service delivery [3]. Engaging in social media is therefore about governance and accountability, which in turn is also susceptible to simplification and manipulation. For example, the BP oil spill showed just how influential passive observers can be, using their thumbs to spotlight negligence in responding to a disaster [4]. On the other hand, the speed with which content is generated combined with the penchant for negative and superficial content distributed through echo chambers can result in the ease of co-optation and distraction.

Dimensions of civic engagement between individuals and institutions involving social media are especially pronounced during crises and disaster. The infinitesimal information exchanges highlight instances whereby individuals far afield can know about an event before those physically close to its location. Geographical distance is less of a barrier for information sharing, and Twitter in particular, often serves as the first communication medium that people turn to for their early warning systems, presenting the potential to reduce risks and save lives,

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but also raising the potential for confusion and panic depending on what information is accessed and amplified [5]. For these reasons, government and public service initiatives have sought to make use of social media in disaster management by operationalizing information sharing to influence management outcomes [6]. For example, in response to Jakarta's regular flooding events, a crowdsourced and geotagged Twitter platform called petajakarta established a 'geosocial intelligence' portal for flood response by incorporating netizens as part of the city's disaster management agency operations [7]. Though not without its problems [8], a reversal of roles began to take place whereby the disaster agency no longer leads the response effort, but rather, are guided by the early warnings from real time information produced by residents, reshaping the city's operations during a flood event that have come to reroute the city's traffic patterns.

Examples of such geosocial intelligence for disaster management as this one have inspired researchers and practitioners not only to innovate service delivery, but also to view the potential for social media to completely retool the relationship between people and government agencies [9]. Building on frameworks examining the quality of netizen engagement from disaster management [10], we analyze the overall governance implications of Twitter discourse in a particularly vast and complex disaster, the recurring forest fire and haze disaster in Indonesia. In this case, we focus on the fires of 2019, which unfolded over a period of several weeks. The overarching research question examines the ways in which Twitter serves as a medium for civic engagement, and how such engagement translates into improving outcomes for disaster management. To pursue this research objective, the operational questions hinge on three different aspects of the fire disaster, which we examine by: i) categorizing the types of engagement; ii) identifying key actors involved; and, iii) determining the outcomes that emerged as a result of the Twitter discourse. We foreground our theoretical approach under the guiding principles from critical data studies by considering the way in which data is produced, the ethics of accessing such data, and the way that data is then analyzed and operationalized [11,50].

The paper proceeds as follows. The remainder of the introduction provides the broader context of fires and haze in Indonesia. Section two provides a literature review of social media and disaster, critical data studies, and civic engagement to position governance frameworks for assessing the quality of Twitter discourse. Section three presents the methods of big data analysis using the social media monitoring tool, Drone Emprit Academic (henceforth, DEA) [55] and our method for scraping 316,782 tweets, as well as the approach for subsequent categorization, text analysis, and triangulation of the data. Section four presents the results of the discourses generated, the influential actors involved, and the overall analysis of the type of civic engagement. Section four situates the results, which point to the political and geographical dimensions of a disaster that overlooked its victims.

1.1. Indonesia's fire and haze disaster

The wildland fires of Indonesia and the resultant transboundary haze problem is a consistently recurring phenomenon in Southeast Asia; pronounced during drought periods, with extreme flare ups every few years [13,16]. The geography of the fires burn from lowland regions of drained, ignited, and smoldering peatlands, most notably seen through satellite images indicating hotspots blanketing the islands of Sumatra and Kalimantan. The fires pose severe danger to human health as the resultant haze can travel far afield from the site of ignition. The 2015 event resulted in more than half a million acute respiratory infections, totaling 19 casualties, and resulting in over 100,000 identified cases of premature deaths [15,17,52]. The economic effects of the 2015 event shut down major economies for several days, closing schools and businesses in Singapore, creating geopolitical tensions between Indonesia, Malaysia and Singapore. The World Bank estimated that the 2015 fires were responsible for an estimated US$1.6 billion in losses, or an equivalent of almost 2% of GDP [15], while burn estimates totaled 2.6 million hectares [17]. Furthermore, the fires emit unusually high levels of greenhouse gases, estimated at 1.2 billion tons of carbon dioxide equivalent (Huijnen et al., 2016), and is responsible for Indonesia's role in more than half of the world's land based emissions [18].

The political economy of Indonesia's fires are driven by profit incentives underpinned by the rapid expansion of plantations in the past two decades, which establish the conditions for fires [17]. Fire is the fastest way to clear land. Though at times attributed to smallholders, [16] have more recently challenged the overall notion of slash and burn as the main factors of fires by distinguishing the factors that transition from surface level fires to the much more toxic sub-surface peatland burns. No doubt the political economic foundations of land valuation and rent-seeking that produce land conversion through the cheapest means (i.e. ignition), is a fundamental backdrop for the anthropogenic dimensions of this disaster. They also shape the contours of possibility in terms of the incentives to mitigate and respond to the disaster.

2. Literature review

2.1. Social media, critical data studies, and disaster

The earliest studies on social media and disasters were described as 'new media,' and evaluated the potential for new mass communications relative to mainstream data reporting. For example, the aftermath of the Indian ocean tsunami, and the profound increase and interest in disaster management studies that ensued afterwards began to examine emerging mediums such as blogging for its ability to help explain disasters [5]. This was at a time when Facebook was still a nascent application, but even during the Indian Ocean tsunami of late 2004, broader publics were becoming aware of the possibilities for accessing sharing personal accounts of disasters. Individual media production and distribution has since flourished through handheld devices. Studies in the disaster literature of that time focused on how social media narratives could rebalance information sharing towards less traditional users, challenging the considered unfair depictions of disaster distributed by traditional media.

As new media transitioned into the world of contemporary social media, research has sought to engage with the theoretical, methodological, and applications of various data points and their accessibility. Studies are increasingly examining the way that data is produced, how various actors interact with data, and promote findings [19]. Critical data studies, for example, promotes examining data by unpacking assemblages, as well as exploring the relationship between the data and its uses, as well as how data accessibility and manipulation reshape the relationship between technology and society, as well as the new processes that are created as a result of data sharing modes [11,50].

The more normative disaster management literature promotes the practical uses of social media around the disaster cycle. For example, this broadly includes how to use social media analysis to make sense of a disaster [20] and frameworks for making sense of the data [21]. Others disentangle social media uses across temporal scales [22], focus on spatial elements of geotagging [24] or volunteered geographic information [26] examining dimensions of preparedness and response [6,27,29,31], and recovery, as well as examples of transition between the stages of the disaster cycle [56]. Others have developed applications in the form of indices of overarching disaster risk reduction principles such as resilience [32,33]. Most of these studies are also tied to social media applications by drawing on empirical studies of a particular hazard, such as hydrometeorological [3,34], or a particular geographic location, like a city [9]. Practical applications are also being incorporated into social media platforms, such as Facebook, which features a mark yourself safe function during major disasters. One study examining the role of Twitter in facilitating debates about climate change issues [35] is optimistic about how Twitter facilitates public debate and produces various discourses about topics rarely found at mainstream media platforms.

The COVID-19 pandemic, at the time of writing an emerging disaster

with global ramifications, also highlights a new dimension of social media and its uses, oscillating between issues of state-mandated apps, contact tracing, data collection, regulations, and responses – which are sure to yield profound new insights on social media uses in the near future [36].

2.2. Civic engagement and social media

Although social media holds much potential for governance and citizen participation, formal institutions and agencies still use platforms in a limited fashion, namely as a site for one way information dissemination rather than a process for meaningful participatory dialogue or service improvement [37]. Even in more natural coalitions of globally coordinated networks of similar concern - such as global environmental NGOs on climate change - social media uses are still fragmented in its applications [38]. Therefore, although public discourse and communications are being reshaped by social media, coordinating governance outcomes around such issues have been reactive and much less deliberate. The Nepal earthquake of 2015, for example, which developed careful preparation of social media uses in disaster management plans, were just as soon discarded during the event [39].

This study therefore builds on the way that civic engagement emerges through social media amidst a disaster situation. Our focus is around the quality of data that emerges from a particular type of disaster scenario, and specifically, we selected a case study that had time to develop so that we could assess the broader levels of civic engagement that took place throughout the disaster. We also selected a disaster that was not localized, but which had widespread geographic impacts in order to study the broader civic mindedness towards the event.

We selected Twitter as the medium for this research because it provides specific realtime data around an issue of public concern, specifically around the use of the hashtag (#) feature that signifies information around a particular public discourse [40]. Furthermore, Twitter is distinct from other social media platforms like Facebook, Instagram, and YouTube that closes off the Application Programming Interface (API). Twitter opens API and creates the possibility for users and researchers to extract all data discussions for a specific period of time.

We set up a research model that would identify to what extent the information being shared on social media influences perceptions about a disaster, what users viewed as important, as well as the indicators for ways that key groups were responding to the disaster. To establish a methodological framework for analysis we looked to framings from studies of governance and used the concept of civic engagement to translate the process and outcomes of public discourse regarding a disaster. The framework thus helped us determine the level of civic engagement on Twitter and the ways that netizens engaged with, and influenced the outcomes of was deemed important in this disaster. We drew from [41] definition and framing of civic engagement as 'the ways in which citizens participate in the life of a community in order to improve conditions for others or to help shape the community's future.' The particulars of how we define, develop, and categorize the key elements of civic engagement are detailed in the methods below, which we draw from applications by [10] who also established an index to evaluate civic engagement based on the case of Hurricane Haiyan in the Philippines.

3. Methods: big data analysis and applying a civic engagement framework

Data collection for this article utilized a social media monitoring tool called Drone Emprit Academic (DEA) [55], which is a technology based on artificial intelligence or machine learning that conducts natural language processing. Applying the DEA, we collected 316,782 tweets over the period of 8–21 September that corresponded with the height of the, 2019 fire and haze disaster (see Fig. 1 for temporal distribution of total tweets). We applied the keyword '*kebakaran hutan*' [forest fires] as the most prominent characterization of the disaster during that period.

As a big data study methodology the DEA produces both quantitative and qualitative data results. The quantitative data are in the form of number of tweets, sentiments (both positive and negative elements), trends of the number of tweets per day, the types of engagements (likes, retweets, shares), and most sentiments. The quantitative data allowed us to answer the first part of the research question related to the types of awareness that netizens raised about the 2019 fires. Next, the notion of 'most sentiments' provided the qualitative elements of our data analysis. Taken together, we began by identifying the key actors involved, which allowed us to identify the powerful actors through a social network mapping that showed not only the power relations between actors, but also spotlighted who is most aware and interested in the dynamics of forest fires. Thereafter, we identified the key types of responses that emerged from the Twitter discourse by analyzing text for the top 100 most retweeted data, which we further explain in the text classification system below.

3.1. Text analysis

We conducted three steps for our text analysis (see Fig. 2). First we compiled Twitter data with the keyword 'kebakaran hutan' and used the DEA social media monitoring tool [55]. Within this step, we chose the five main data categories presented by the DEA to include the 100 most retweeted tweets, the three most shared videos, the three most replied tweets, the top three most shared images, and produced a social network mapping by clustering key actors and discourses. Secondly, we conducted manual textual analysis on the first four data to identify the discourse categories. In this step we adopted a manual classification data method [13] to establish the discourses identified as *civic engagement* that [41] categorize in terms of solidarity, responsibility, and agonism, [42,43]. Finally, we drew from [10] sorting approach of civic engagement under the following rules:

Fig. 1. Trend of total mention '*kebakaran hutan*' on Twitter [forest fires] (DEA, 2019).

- The agonism indicator (indicator 1) involves tweets that are geared towards political critique and other related social opinions. Such political critiques tend to be directed towards the government, or other criticism that assigns blame. For example, as we will show in the empirical sections, the Kalimantan and Sumatra cases included a large volume of tweets blaming local communities for their own role in degrading the landscape that now threaten them.
- The solidarity indicator (indicator 2) includes tweets that express care, empathy, or solidarity toward the victims, as well as tweets that encourage netizens to showcase emotions of goodwill, hope, and prayer for the victims.
- The responsibility indicator (indicator 3) includes tweets that inform the public about ways to provide support, such as opportunities for charity or other avenues to help. This indicator of responsibility also transmits key information such as warnings or guidelines to avoid/stay clear of the disaster, as well as information about volunteers and volunteer opportunities
- Others narrations (indicator 4) that did not fit into the above three categories, included items that may have used the hashtag *kebakaran hutan* but were unrelated to the topic.

By applying the three indicators, this research identified the type of civic engagement that took shape during the study period. We assume that Twitter not only provides a forum that aggregates the views for a large cross-section of society, but as shown elsewhere [4] also has the potential to play an outsized role in disaster management if the form of civic engagement helps to initiate or guide actions that result in preventing damages and losses, or supports the allocation of resources. Our framework also assumes that Twitter plays a limited role in disaster mitigation if netizen engagement overlooks the direct and immediate impacts on victims, especially if the discussions are confined to non-actionable discourses such as critiques, assigning blame, and others.

The last step included analyzing actor networks by conducting a mapping exercise produced from the DEA. The social network data was produced from the 500 most retweeted tweets and helped to explain the various ways that civic engagement took shape. The social network data identified key actors involved, the clusters of social networks that took shape, and list out the various identities of actors that dominated each cluster. We thereafter explored the power relations between actors and clustered them across social media networks to highlight their various alliances. In visualizing the social networks, the DEA tool applied a fundamental first step in the concept of social network analysis [44], whereby Twitter accounts were assigned nodes by actor; listed out the retweets, likes dan replies, which were translated as 'relations ties' and grouped nodes that are connected with one another and are called 'groups' or 'clusters'. The more numerous the 'relations ties' that one actor has, the closer their relations are to one another and the clearer the their ties are, which are symbolized by a dot. Meanwhile, the actors that more intensively retweet suggest they are also in closer proximity with one another. Applying this algorithm through the DEA will create a social network visualization based on their groups or clusters. This raw data then allows us to extend the analysis about hte power relations between actors, between discourses, and between clusters. Finally, across each of these steps, the stages of data collection provided us with the evidence base for addressing the larger research objective towards understanding how civic engagement on Twitter reflect the broader understanding and priorities governing this disaster.

4. Results and discussion: awareness, actors, and civic engagement

4.1. Twitter fire discourse

The first text that emerged during the period of study relating to kebakaran hutan [forest fires] was tweeted on September 8, 2019 at 00.04 by @Bram_Tio18,[1] included the following:

@Bram_Tio18	[original text] @vivanewscom@VIVAcoid MASYA ALLAH.., JANGAN LAGI ADA KEBAKARAN HUTAN DAN LAHAN PAK @jokowi, Udara sudah tidak sehat ini… banyak asap" @vivanewscom@VIVAcoid please God.., no more forest and land fires Mr President @jokowi, the air is no longer safe… lots of haze. 8/Sept/2019 at 00.04 WIB Graph

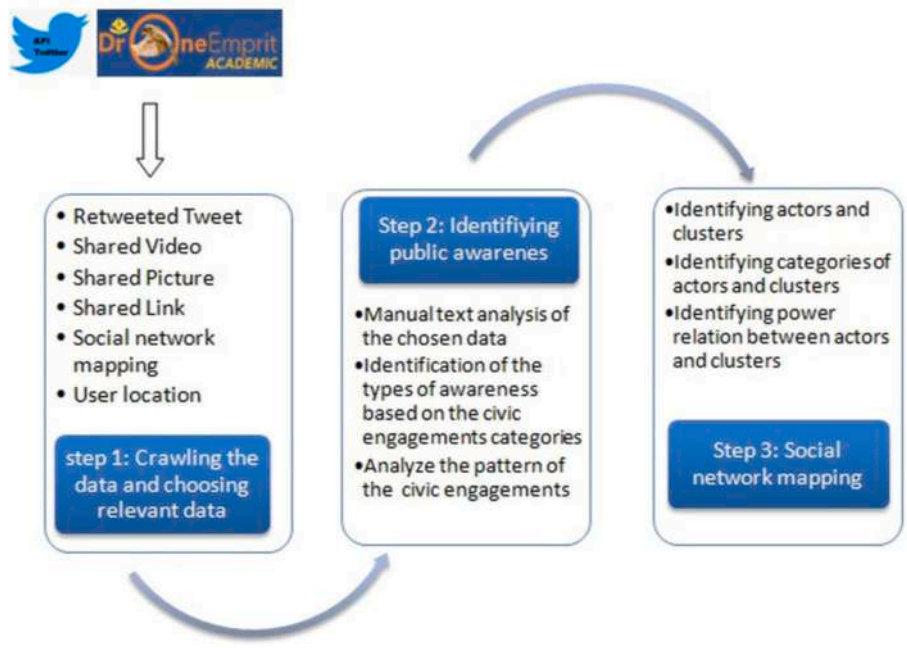

Fig. 2. Methodological framework for data collection and analysis.

[1] https://Twitter.com/Bram_Tio18/status/1274895915200466944.

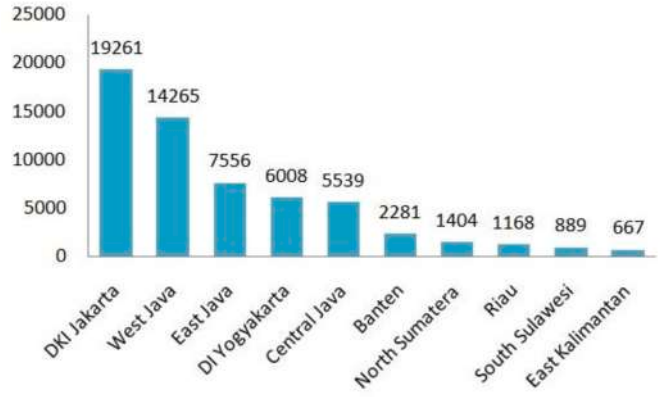

Fig. 3. Highest volume of forest fire Tweets produced by Indonesian provinces [55].

This tweet at once raises awareness about the issue of forest fires as a plea and a prayer, while pointing to political attention about the urgency of the matter to President Joko Widodo. It also explicitly calls for the attention of mainstream media outlets.Of the 316,782 total tweets produced during the time period, the DEA identified 215,306 total tweets with negative impressions about the forest fires. The peak time of tweets during the study period took place on 16 September 2019, with a total of 58,075 tweets. Meanwhile, the engagement types on Twitter in large part consisted of retweets for a total of 286,141 followed by mentions at 21,193 and replies at 9448.

Viewed from the geographic distribution on the locations of the tweets yielded information that most of the netizens live (or were located in) the capital city of Indonesia, Jakarta, amounting to 19,261 users, followed by other large cities in Indonesia, including Bandung (6,134), Yogyakarta (5,412), and others (35,850) (see Fig. 3 and Map 1). While the remoteness of the fires highlight the low likelihood of a high volume of tweets from the sites of the disaster, the data nevertheless clearly shows the political nature of the tweets taking place in the largest metropolitan areas of Indonesia (see Fig. 3).

Meanwhile, the hashtags associated with fires are presented in Table 1. From the top ten fire-related hashtags, the most commonly used was #RIAUDIBAKARBUKANTERBAKAR. The broader meaning of this hashtag is a commentary about Riau – the main province where the fires took place on the island of Sumatra – and describes a sentiment that expresses 'Riau isn't burning, it's being burned.' This hashtag also shows the overall critical sentiment among netizens about the unnatural character of this disaster. As such, this dominant hashtag points to the political critique directed towards the government and the political actors involved in creating the conditions of disaster, which was at the forefront of concern among netizens. As we will apply throughout our methodological framework on civic engagement, it is clear that this hashtag, #8 and #9 are overwhelmingly concerned with sentiments that fall under the category of Agonism (indicator 1). The next set of most tweeted hashtags (#2–4) are more descriptive about the nature of fires, and simply describe a worsening condition of the fires. Combined with #10, these tweets point to the unfolding emergency, and fall into categorization of responsibility (indicator 3). Thereafter, hashtag #5–6 are specific to geographic regions in Riau province and across Kalimantan point to sentiments of solidarity (indicator 2). Hashtag #7 also falls under our category of responsibility, but is unique because it expresses the opposing sentiment compared to the others. As fires are attributed to the broader political economy of land clearing and burning for rapid plantation expansion in Indonesia, hashtag #7 seeks to reframe the narrative that plantations are for the good of Indonesia. In other words, this hashtag reacts to the blame for forest fires by assigning it elsewhere.

Nevertheless, this more controversial hashtag #SawitBaik also received considerable backlash as numerous netizens considered the timing insensitive. This was most prominently expressed through an actor and prominent comedian @ernestprakasa[2] (with 681,173 followers), in as tweet that received 1821 retweets, as follows:

@ernestprakasa	[original text] Belum beres urusan KPK, muncul lagi #SawitBaik, kempen korporasi yang didukung ama Kemkominfo, di tengah kobaran kebakaran hutan. Sebagai pendukung Jokowi di pilpres, gw serasa lagi kena prank Atta Halilintar. Although the Corruption Eradication Commission [KPK] issues are still not finalized, but #SawitBaik still emerges as part of the corporate campaigns, which is also supported by the Ministry of Communications and Information, even though the fires continue. As a supporter of Jokowi in the presidential election, I feel I am again the target of Atta Halilintar's [a prominent Youtuber in Southeast Asia] mischief. 16/Sep/2019 17:23 WIB Graph

He points to the weakened role of the Corruption Eradication Commission (KPK) to fulfill its role in addressing corruption, and by voting for Jokowi in the previous election, he concludes that this campaign is paramount to hypocrisy, likened to being fooled by one of the most famous Youtuber pranksters in Southeast Asia. Indeed, the #SawitBaik hashtag sought to generate a positive narrative about palm oil amid the fires to distance the industry as the culprit by promoting a political marketing campaign to counter the negative perceptions of palm oil [45].

4.1.1. *Civic engagement in the most popular tweets*

In this section we present two ways of examining civic engagement through textual data on Twitter. The first is reflected in the three most popular tweets, in which the DEA analysis was separated into four categories: Top three retweeted; three most replied; three most shared videos; and, three most shared images (see Table 2). The results provide

Table 1
Top Ten Twitter Hashtags about fires.

Rank	Hashtag *[Approximate English translations]*	Civic Engagement Category	Frequency	%
1	#RiauDibakarBukanTerbakar *[#RiauBeingBurnedNotBurning]*	Agonism	43,925	62,7
2	#KebakaranHutanMakinMenggila *[#ForestFiresGettingCrazier]*	Responsibility	4574	6,5
3	#IndonesiaDaruratAsap *[#IndonesiaHazeEmergency]*	Responsibility	4198	6,0
4	#karhutla *[forest and wildland fires]*	Responsibility	3205	4,6
5	#saveriau	Solidarity	2796	4,0
6	#SaveKalimantan	Solidarity	2687	3,8
7	#SawitBaik [#PalmOilGood]	Responsibility	2410	3,4
8	#RiauMelawanAsap *[#RiauFightsFires]*	Agonism	2357	3,4
9	#HukumPembakarHutan *[#JailForestIgniters]*	Agonism	2007	2,9
10	#IndonesiaForestFireCrisis	Responsibility	1872	2,7
	Total Hashtag Mentions		70,031	

[2] https://Twitter.com/ernestprakasa/status/1173542844826451969.

Table 2
Civic Engagements categories in the Top 3 Most Popular Tweets.

Tweets categories	Narration	Freq	Civic engagement categories
3 Most Retweeted	Haze warning and critique mentioning @jokowi	42,658	Agonism
	Negative sentiments towards Jokowi about his disability to address disasters	26,637	Agonism
	Prayers so that the fires will end	21,174	Solidarity
3 Most Replied	Critique towards anti-Jokowi sentiments	96	Agonism
	Jokowi's Tweet about the deployment of fire fighters and equipment to affected locations	93	Responsibility
	Criticism towards Jokowi's promises of overcoming fires	36	Agonism
3 Most Shared Videos	Critiques towards Jokowi's slow respond in addressing forest fires	609	Agonism
	Front Pembela Islam (FPI) supports forest fire fighting efforts	265	Responsibility
	Criticism on the lack of Jokowi's seriousness in addressing the forest fires	147	Agonism
3 Most Shared Images	On reports of a giant snake being caught in the fires	676	Solidarity
	Prayers so that the fires will end	356	Solidarity
	Information on the 3000 fire hotspots	112	Responsibility
Total number of civic engagement on each category			Solidarity: 3 (25%) Responsibility: 3 (25%) Agonism: 6 (50%)

an overall picture of public awareness by aggregating quantitative figures among netizens on the ways they reacted and responded to news about forest fires. Table 3 provides a complementary analysis of text on the 100 most retweeted tweets in a singular category by listing and categorizing them into different civic engagement classifications. This approach to analyzing civic engagement listed in Tables 2 and 3 provides a clearer representation about the particular ways that netizens reacted to the forest fires.

4.1.1.1. Civic engagement in the top three most retweeted tweets. By analyzing the top three most popular tweets (Table 2), we were able to show the various categories of tweets and their ranks, and further categorized them by type of civic engagement. The data shows that the most likely category to emerge was agonism, at six tweets distributed across the three most popular tweets, followed by responsibility, which received four tweets, and solidarity, which received 3 tweets.

A closer look at the content we categorized under agonism points to sentiments centered around critiques among netizens towards the central government (in this case directed at the Jokowi administration), or conversely, defenders of Jokowi's policies. These findings are a reflection of the political dynamics of that time, unfolding during a tense presidential election campaign. These findings provided the foundation for our larger argument on the limitations of Twitter as an effective tool for disaster mitigation, which can easily be co-opted for political purposes. These agonism sentiments are focused on overarching concerns to address fundamental policies that create the conditions of fire disaster risk. The sentiments were much less focused, however, on the pressing needs faced by those amid the disaster, such as concerns of helping victims, saving lives, and addressing short term economic losses. Rather, the Twitter discourse largely took shape around land use and land management policies, approaches to firefighting, and the political dynamics that led to fires in the first place. This is unsurprising for the dynamics of this particular disaster, unfolding in a region at the peripheries of the state, which was concurrently embroiled and drawn into the tense political contestations unfolding at the center.

Meanwhile, the indicators of responsibility and solidarity are geared towards raising awareness for supporting the immediate concerns among victims of the forest fires (people, animals, and the environment). The results from examining these categories also do not point to much attention around potentially meaningful applications for Twitter in disaster response or relief for its victims. For example, the responsibility indicator was dominated by information that is commonly described as armchair activism or slacktivism, a process whereby netizens give a sense of providing support by expressing concerns for doing the right thing [46]. In other words, in terms of civic engagement the Twitter discussion was rarely geared towards actionable responses for helping those experiencing the direct effects of fires. In this regard there was an overwhelming echo chamber of support for Jokowi policies, and these were largely relegated to retweets.

Some evidence emerged of civil society organizations moving beyond armchair activism to an actual show of support in the field. One civil society organization - the Islamic Defenders Front (FPI) - with a large following received significant attention across their networks for a tweet about providing support for mobilizing fire trucks. However, the organization is also well-known in Indonesia for its practices of drawing political attention on a wedge issue as a way to seek out political favoritism. In regards to FPI on this issue, there is actually very little evidence that the initiatives raised by FPI's tweets directly related to providing any relief for, or mobilizing actions that supported victims.

Finally, solidarity tweets were especially popular and highlighted several themes in the form of prayers. The types of prayers were shaped by hopes among netizens for the rains to quickly return, prayers for the health and wellbeing (and loss of life) among victims or concern over the loss of wildlife.

4.1.1.2. Civic engagement in the top 100 most retweeted tweets. To deepen our analysis on civic engagement, in this section we further categorize tweet data in qualitative terms. Table 3 provides an indexing based on the content of tweets in the 100 most retweeted tweets. Retweeted tweet data was choosen because it contains 90.33% from the total Twitter users activities comparing to reply (2.98%) and mention (6.69%) [55]. We did this to examine the quality of potential civic engagement from the messages contained within the aggregated tweets above. Among the top 100 most retweeted tweets we focused on identifying issues that emerged from each civic engagement indicator to provide a more representative scaling. The intent was to show how the role of Twitter

Table 3
Civic Engagement in the top 100 Most Retweeted Tweets.

Civic Engagement categories and the narratives	Number of Tweets
Agonism (49%)	
Critiques directed at Jokowi	46
Critiques towards palm plantation and timber companies	2
Critiques towards demonstrators	1
Solidarity (24%)	
Prayers and blessings	13
Concerns for victims and children, animals (e.g. snake and orangutan)	8
Praising Jokowi policies	1
Calls for support for disaster recovery functions	1
Collecting donations for victims	1
Responsibility (24%)	
Information about the forest fires (sources, hot spots, area burned, about correct safety masks, economic losses, community complaints); information on relief services for victims (Jokowi government and public relations departments); information of donation/help given by religious civil society organization (FPI dan NU)	17
Warning about haze and fires	6
Calls for donations on Twitter	1
Irrelevant narrative	3
Total the most retweeted tweets	100

might function in supporting disaster management outcomes from the perspective of its mobilization potential based on the information presented by netizens.

Table 3 also presents an index that separates the quantitative elements regarding civic engagement from the top 100 most retweeted tweets. The data reinforces that the dominant issues could be categorized into the agonism indicator (49%) compared with the solidarity and responsibility indicators each at 24%. Meanwhile, the textual analysis for the 100 most retweeted tweets presents a narrative within each of the broader indicators similar to the findings in the top 3 favorite tweets listed above, namely that the agonism category dominated in the form of criticism directed towards the government. This was followed by responsibility, shaped by a narrative of information sharing about the fires; and the solidarity indicator describing prayers and blessings for victims.[3] The following subsections (B1, B2, and B3) present a closer look at the narrative within each of the major most retweeted indicators within the analytical framework of civic engagement.

4.1.1.3. Agonism: critiques of government policy on land use and pro-investor policies. The agonism indicator highlights that civic engagement categories were foremost shaped by a narrative about the broader critique over failures of the Jokowi administration to address the forest fires (46%). This narrative was legitimized with the underlying argument that Jokowi policies have been too investor-friendly. Such sentiments evidenced Jokowi allowing for the rapid conversion of forests and expansion of plantation lands, specifically for oil palm development. This sentiment drew particular attention in light of Jokowi's populist campaign promises, highlighting the unfulfilled commitments to capture and punish those implicated in the fires. For example, one of the agonism tweets gaining widespread attention among netizens about the loss caused by the forest fire according to The National Disaster Mitigation Agency BNPB, 80% of the burnt forest turned into palm oil orchard and other industrial plant forest (Indonesia, 2019). The tweet by Greenpeace Indonesia[4] (with a total of 936,792 followers) was in the top 15 of the 100 most retweeted tweets, get a total of 2292 retweets. This tweet and critiqued the Jokowi administration as follows:

@GreenpeaceID	[original text] Pemerintah dalam hal ini Presiden @jokowi pernah digugat untuk kasus kebakaran hutan dan lahan 2015, dan masyarakat menang. Alih-alih menjalankan perintah pengadilan, pemerintah lebih memilih banding atas gugatan masyarakat. https://t.co/RLomLWXZxq The government, in this case the President @jokowi administration, had been sued for a case of forest and wildland fires in 2015, and the people won. Rather than following justice and the law, the government chose to appeal the decision and sue the people. 15/Sep/2019 17:29 WIB Graph

Another popular tweet suggesting Jokowi policies are pro-investor include the sentiment about the openness the government has been in issuing conversions of forest land into plantations for corporate investors was tweeted by media outlet tirto.id[5] (with 341,541 followers) and retweeted 821 by netizens:

@TirtoID	[original text] Walhi mengkritik keras pernyataan Jokowi yang dinilai terlalu banyak memberi "karpet merah" untuk investasi, tetapi lupa dengan kebakaran hutan dan lahan yang makin parah. https://t.co/GuX4yS4Sel Walhi [Indonesian Environmental NGO] harshly criticizes Jokowi statements on rolling out the "red carpet" for investment, while he forgets about the forest and wildland fires that are getting worse 14/Sep/2019 13:00 WIB Graph

The @TirtoID tweet links to an article that contains criticisms by *Wahana Lingkungan Hidup* (Walhi, or the largest environmental NGO in Indonesia) directed at the Jokowi administration. The article indicates that the government provides preferential treatment to corporate investors and suggests those investors are the ones responsible for the increased intensity of forest fires in Indonesia. It further highlights the ease with which the administration has supported investors in converting land, contrasting it to the lack of attention by the administration for addressing forest fires, overlooking the adequate scrutiny over concessions and concessionaires and their unfulfilled environmental audits. Walhi in the article demands that the administration review regulations to slow destructive investments, particularly the large scale ones driven to support Foreign Direct Investment (FDI). In this view, Jokowi's pro-investor policies thus are the target of the larger narrative about the source of forest fires, indicating the administration's lack of commitment to addressing the forest fires.

Others also critiqued the administration's visits to the fire sites as a public relations stunt. These tweets suggested that Jokowi was addressing forest fires as a way to improve his political image. For example, @FaizaMardz[6] (at that time with 2781 followers) received 6350 retweets at the number 9 of the top 100 most retweeted tweets with the following tweet:

@FaizaMardz	[original text] Seorang pejabat Indonesia memamerkan sepatunya yang paling kotor karena kerja meninjau kebakaran hutan. Begitulah wahai rakyat Indonesia. Betapa pejabat NKRI itu kerja keras luar biasa sekali sampai sepatunya kotor! https://t.co/eDDx3lAe99 Indonesian political leaders show off their dirty shoes to indicate they are working to survey forest fires. And that's how it goes my fellow Indonesians. Our political leaders are working so hard they even got their shoes dirty! https://t.co/eDDx3lAe99 18/Sep/2019 20:26 WIB Graph

Mardzoeki's tweet – The Cabinet Secretary @pramonoanungw instagram status – received 6350 retweets describing Indonesia's political leaders including President Jokowi showing off their dirty shoes to indicate they were working to survey the fires. The images were posted as part of a trending before-after challenge. Nevertheless, the tweet drew sharp criticism from netizens as exemplified in the tweet above, and

Fig. 4. Instagram by the Cabinet Secretary Pramono Anung highlighting controversy over the administration's response to fire disaster.

[3] Note that the nominal values of these categories do not correspond to the largest number of tweets but rather indicate topical categories that are divided across indicators.

[4] https://Twitter.com/GreenpeaceID/status/1173479425502937088.

[5] https://Twitter.com/TirtoID/status/1172751832457912325.

[6] https://Twitter.com/FaizaMardz/status/1174313736934289409.

concluded that the tactic was geared towards promoting their own political interests (Fig. 4).

*Translated text: @pramonoanungw Shoes before and after a visit to fire affected regions in Pelalawan Riau. Shoes of president @jokowi, Coordinating Minister of Politics, Law and Public Safety @wiranto. official, and the Minister of Public Works and Housing and @pramonoanungw above on the President's Helicopter, where are my shoes? Just look at the dirtyest ones #addressingthehaze #workworkwork #riau.

4.1.1.4. Solidarity: sending prayers. Most retweet categories were dominated by a call for sending prayers and well-wishes to the victims (at 13 total themes within the category). The highest retweeted tweet (497) conveyed prayers to the victims, which was posted by a religious civil society organization, Nahdlatul Ulama (NU)[7] who have a total of 350,187 followers (Ulama, 2019). In the tweet, NU calls for its leadership to conduct a special prayer session (sholat istisqo') calling for the rains to quickly return:

@nahdlatululama	[original text] Nahdlatul Ulama menginstruksikan kepada Pengurus dan warga NU untuk melaksanakan sholat istisqo' memohon pertolongan kepada Allah SWT untuk segera diturunkan hujan agar kebakaran hutan dan lahan serta kekeringan segera berakhir. https://t.co/TrtDTRiMju Nahdlatul Ulama instructs all of its NU leadership and community to conduct the istisqo' prayer to request that God quickly sends the rains to bring a quick end to the forest fires and droughts. https://t.co/TrtDTRiMju 18/Sep/2019 07:49 WIB Graph

Other topics expressed sympathy for disaster victims and concern for its effects on the environment. One popular tweet expressed sympathy for an orangutan burned while breast feeding, and another for children trapped in regions engulfed by fire. However, these did not generate an aggregate number of similar nodes in those categories. This does not necessarily indicate that those narratives received less attention, but it does point to the lesser emphasis around those areas of engagement. In contrast to the criticisms directed at the Jokowi administration expressed in the agonism category above, the corollary emerged in the solidarity indicator. These sentiments, which were further pronounced in the social network mapping (see Fig. 5), highlighted the strong support for Jokowi's policies and efforts of the administration, expressing solidarity around disaster recovery efforts.

4.1.1.5. Responsibility: Active in sharing information, but lacking information for action. Table 3 shows that the responsibility indicator highlighted the dominant narrative of information sharing (17%), followed by warnings about the dangers of fires (6%) and finally, initiatives to coordinate donations (1%). Information sharing, a key element we categorized under the responsibility indicator, can be extremely helpful for those in a disaster. However, much of the type of information sharing was not directed at supporting the victims. For example, data about the source of hotspots and areas burned can help to either address those locations and help to directly provide relief to people who are in danger, or that need support in the aftermath of a disaster.

A closer look at the tweets about the type of information sharing are nevertheless consistent with the politicization of the disaster discussed above. Information about the locations of the fires did not serve as early warning nor were information sharing taking place about ways to bring relief to victims or evacuate high risk areas, as far as we could glean from the data. Rather, the content was slanted towards finding culprits among concessionaires or highlighting policy shortcomings, or conversely, in defense of the current presidential administration. These findings are not intended to express judgement in a negative way, nor undermine the importance of this type of information sharing, which are clearly intended to affect real policy change for mitigating future disasters. On the other hand, the political discussions about the responsibility indicator, however, which unfolded during an intense national election campaign served to distract from the actionable responses that can support people facing the direct effects of disaster.

One example is a tweet that received significant attention, which we placed in the broader category of information sharing. This tweet raised the topic of economic losses related to the disaster. Such a message offers a powerful message for policy. Nevertheless, during the disaster, such a message can draw attention to an issue while overlooking those that are directly experiencing the hazard. This type of tweet is as follows:

@sumiyati900[8]	[original text] RT@ferizandra: Koordinator Pusat Studi Lingkungan Hidup, Universitas Riau Dr Suwondo MS memperkirakan Riau mengalami kerugian materiil sebesar Rp 50 triliun lebih akibat kabut asap kebakaran hutan dan lahan yang melanda daerah itu sejak beberapa bulan tmaterial [sic] … https://twitter.com/sumiyati900/status/1175009558218993664 The Coordinator of the Environmental Study Center at the University of Riau, Dr Suwondo predicts that Riau will experience material losses at more than Rp 50 trillion due to the land and forest fires and haze that occurred in the region in the past few months. 20/Sep/2019 18:31 WIB Graph

In this tweet, Ferizandra refers to what The Coordinator of the Environmental Study Center at the University of Riau, Dr Suwondo predicts that Riau will experience material losses at more than Rp 50 trillion due to the land and forest fires and haze that occurred in the region in the past few months. Meanwhile, this is not to say that there were not concerted efforts for collective action in support of victims. @AdibHidayat[9] (403,019 followers) gained some support by tweeting around the theme of donating for victims via a crowdfunding organizer, kitabisa.com, calling for netizens to get together to mobilize for the victims. The kitabisa.com site is a credible crowdfunding source in Indonesia that regularly coordinates campaigns to collect donations for communities in need. The tweet received 333 retweets, connecting netizens to the crowdfunding website link, which ended up collecting IDR 63,716,181 (~USD 4400). The original tweet is as follows:

@AdibHidayat	[original text] Mari kita bantu saudara-saudara kita di Riau dan Kalimantan yang terkena dampak dari kebakaran hutan dan lahan ini lewat @kitabisacom. Terimakasih sekali telah bersedia berbagi dan menyebarkan info ini. #SaveKalimantan #SaveRiau #Karhutlahttps://t.co/IJsA1neqUA Let's help our brothers and sisters in Riau and Kalimantan that have been impacted by the forest and land fires via @kitabisacom. Thank you so much for your willingness to share and to spread this information. #SaveKalimantan #SaveRiau #Karhutla 15/Sep/2019 20:34 WIB Graph

4.2. Social network mapping

The social network mapping identified key actors involved, which helped to explain the ways that civic engagement took shape (see Fig. 5 and Table 4). Using the DEA, we were able to highlight the various networks, the larger nodes and their corresponding relationships. Fig. 5 shows the three network clusters that clearly take shape, consisting of notations that we have presented as clusters A, B, and C. These clusters are influenced by the behavior of retweets conducted by one account towards another. The closer the connection between accounts indicates the clearer their network similarity because they have a high intensity of retweet activity. Based on observations of the actors and their networks, results show that cluster A consists of the network of power revolvings

[7] https://Twitter.com/nahdlatululama/status/1174123363754631169.

[8] https://Twitter.com/ferizandra/status/1174903983166476289.

[9] https://Twitter.com/AdibHidayat/status/1173228581918396416.

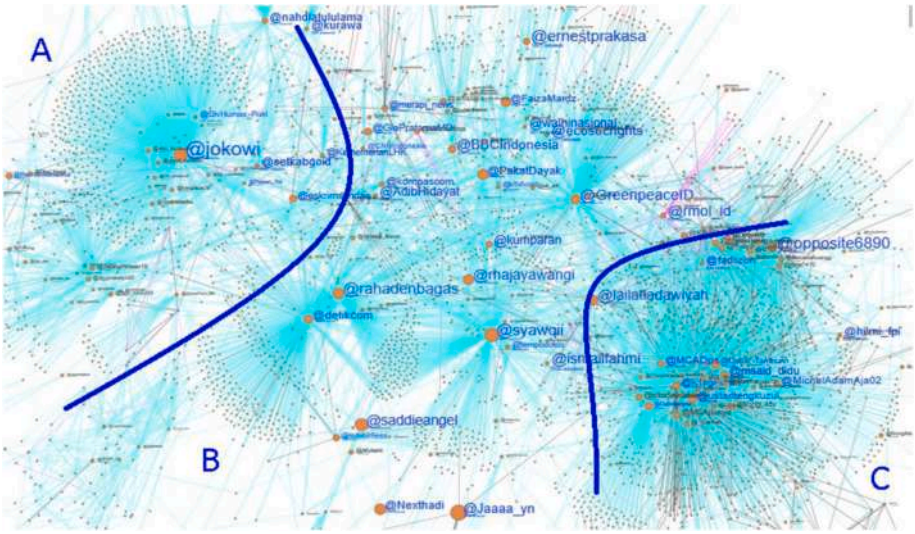

Fig. 5. Social network mapping for the 2019 forest fire disaster [55].

around the official account of President Jokowi and others in support of the narratives around the @jokowi account. Cluster C is the opposing view from the @jokowi account. Meanwhile, Cluster B consists of networks in between the polarization of these two camps, which we term as the neutral network.

Furthermore, we also traced the identity of each of the actors that controlled the narrative based on the volume of retweets. We check the backgrounds of the key accounts in the social network mapping manually through an examination of the individual accounts on Twitter.com. We also cross-checked the authenticity of the account at https://www.Twitteraudit.com/. This approach helped us to identify who owned the account and decide whether this was an 'organic' account or a pseudonym. The results are presented in Table 4, which shows how Cluster A consists of the network in support of the Government. Cluster A is in direct opposition with Cluster C, which is mostly controlled by pseudonym/anonymous accounts that has created a strong network. Meanwhile, cluster B, consists of other networks that do not directly affiliate with Cluster A or B. The dominant profiles from this neutral cluster include accounts from prominent mass media outlets, others who also provide criticism toward Jokowi such as public figures, environmental NGOs, and other civil society sub-clusters.

Identifying the networks under these three clusters (and the main actors that shape them) helped to further explain the broader characteristics of civic engagement identified in section 3, and confirms the overall propensity for agonism. This is clearly due to the intense political rivalries shaped by cluster C, which included several sub-clusters of actors that heavily critiqued Jokowi's policies in both the 2014 and 2019 elections. This phenomenon is not solely present in the conditions of this research as Indonesian politics are well-known to involve intense manipulation of public discourse through 'hoax' and 'hate speech' among the vast number of influential pseudonyms and anonymous influencers [47,51].

Map 1. Visualisation of Forest Fire Hotspots (BNPB, September 16, 2019, 9 a.m.); Twitter user location during the forest fire [55].

Table 4
Mapping of the Most Active Users and Cluster in the social network mapping.

Cluster	Frequency	%
Cluster A. Government supporters		
Government		
President	1	2,4
Ministry	2	4,8
Security Forces		
Police	1	2,4
Army	1	2,4
Civil Society Organization		
Religion Based Mass Organization	1	2,4
Anonymous Twitter Account	1	2,4
Number of most active user in the Cluster A	7	
Cluster B. Neutral Actors (no affiliation with other networks)		
Professional Media		
National Media	7	16,7
Local Media	1	2,4
Citizen Media	2	4,8
Civil Society Organization		
Environmental NGOs	1	2,4
Socio Economic NGOs	1	2,4
Public Figure		
Celebrity	1	2,4
Social Media Analyzer	1	2,4
Layperson	3	7,1
Anonymous	3	7,1
Number of most active user in the Cluster B	20	
Cluster C. Government opposition		
Professional Media	1	2,4
Politician	2	4,8
Civil Society Organization		
Religion Based Mass Organization	2	4,8
Anonymous	10	23,8
Number of most active user in the Cluster C	15	
Total number of most active user in the cluster A+B+C	42	

In between the larger rivalries taking shape between Cluster A and C, warranted a closer look at the role of the neutral cluster. These include accounts of NGOs, public figures, media organizations, and celebrities that sought to shape the discourse on the disaster in particular ways. Several of these clusters, led by the environmental NGOs were focused on the critique of policies that caused fires in the first place, which align with the longstanding network of institutions around the world interested in the future of Indonesia's tropical forests. This is evident from organizations like @greenpeaceID, which had for a long time pointed out the environmental justice dimensions of land enclosures and the degradation of forests. Unsurprisingly, their message continued to highlight the political economic dimensions that led to the fires. Nevertheless, these types of messages focused on the longer term structural reforms related to land management and biodiversity rather than the immediate needs of those suffering amidst the disaster.

Unfortunately, these networks and the discourses that they promote establish political dimensions that clearly serve as detractors to connecting services to people in desperate need during a disaster. This is further reinforced by the spatial dimensions of the disaster. The location of the disaster are presented relative to the areas of influence from the networks on Twitter in Map 1, and show that these discourses are not being shaped by individuals located in the rural regions of Borneo and Sumatra, and reinforce the overall argument about the opportunism of political rivalries that shift the focus away from mobilizing resources towards their own broader political interests. Although we recognize that previous research has critiqued georeferenced analysis as a basis to making claims about disasters [24], nevertheless, the spatial dimensions of tweets in this case presents a convincing geographic argument. Java is indeed the population center of Indonesia, so it is unsurprising that these numbers are skewed, and yet when viewed in the context of the quality of civic engagement on Twitter presented throughout our results, the discourse confirms an overwhelming narrative being shaped by interests far from the site of fire ignition and suffering.

5. Conclusion

While the more normative research on social media engagement and disasters have tried to develop a better understanding of applications for disaster management, we examined the extent to which levels of civic engagement are shaped through Twitter. Foregrounded through the theoretical grounding of critical data studies that focuses on the assemblages that shape relationships between technology and society, we extended methodological applications through a civic engagement framework that helped to identify the key discourses produced through Twitter during a particular disaster and considered their potential implications.

Two overarching discussion points are of note. First, the results showed overwhelmingly the influence of electoral politics during the fire disaster in 2019. The timing, and the temporal elements, in which a disaster slowly unfolded during a fiercely contested presidential election made the issue susceptible to broader questions about the legitimacy to govern. The social network mapping showed how pronounced the polarizations were among clusters in support of those in office versus the coalitions seeking to undermine those in power. Defining this narrative engulfed the Twitter discourse and opportunistically used the fires as a wedge to assess or defend political leadership. Our results showed just how much the discourse falls under the agonism category. We quantified this through a categorization of the 100 most popular tweets (top 100 most retweeted tweets) that showed 49% of the tweets falling under the agonism category, whereas the remaining tweets were split between agonism and solidarity. We also clearly showed qualitatively within these tweets the lack of attention for providing support to victims in the times of most pressing need. Indeed, online campaigns have been described as a fleeting political realm, resulting in many clicks in the form of slacktivism, but fall far short of crystallizing into a more consolidated influential movement [46,48].

The social network mapping also highlighted the pronounced polarization between factions. While one side critiqued the current administration for its campaign promises as failing to address the fires, those in power countered with their own narrative of responsibility by showcasing actions through field visits, which also spent a great deal of discourse focused on its very genuineness and authenticity. Those in between the political clusters - such as the coalition of activist groups drawing significant international attention over forest fires - used the opportunity to point to the dangerous effects on people and the environment due to the longstanding legacy of land management preferential towards land clearing for industrial plantations. Such narratives focused on concern about carbon emissions and climate change mitigation. In all, much of the discourse revolved around contesting what caused the fires in the first place. Amid the controversies defining this public discourse on Twitter, the more immediate concerns of supporting and protecting those living through the disaster were overlooked or overshadowed for the aims of more politically driven messaging.

A second dimension that emerged from these findings highlights the geographic elements of this disaster. Our results showed the nominal tweets and the geographic distribution of the fires relative to the Twitter users. As the fires unfolded and suffocated communities in the rural lowland regions of Kalimantan and Sumatra (especially Riau province), much of the discourse shaping Twitter was unfolding in Java and unaffected by the direct impacts of the fires. Java is the locus of

government and decision making in Indonesia, a reflection of historical outcomes and also a function of the highest density populations in Indonesia. It is therefore unsurprising that the concern on shaping the discourse of this disaster revolved around the immediate interests of defining the outcomes during the peak of the political contest for president. As a result, the discourse about this disaster was largely shaped by those that did not understand the complexity of lowland peat fires, and especially did not fully appreciate the dramatic health effects of the fires and its toxic haze. Indeed, the notable attention around fires and haze only gained widespread attention in 2015, when the levels of air pollution from the haze began to affect regional economic centers in Singapore and Malaysia.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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