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## The Muddy Practice of Social Media Crowdsourcing in Bandung City

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**Abstract.** This interpretative case study investigates social media use during three urban floods in Bandung City, Indonesia. The results suggest that social media is widely used by citizens as an alternative means of emergency communication. As for the government, although the implementation of social media in Bandung City Government can be said to be a pioneer in comparison to other city governments, and Bandung governments units were required to implement social media, social media played a very limited role in crisis communication between citizens and government. Reasons for this include fragility in adoption of technology, lack of institutionalization of technology, and a mutual distrust between government and citizens, where citizens prefer to use traditional media to issue complaints and report status updates rather than government agencies. This empirical finding was found based on a multimethod study, using interview data, social media scraping, document analysis and field study as sources of data.

**Keywords:** Social Media, Twitter, Smart City, Government's Response, Floods.

### 1 Introduction

Since about a decade, academic and professional literatures have emphasized the notion of the smart city: a metaphor for data sharing over technological infrastructures for the purpose of enabling sustainability, well-being and quality of life for residents living in urban areas. Availability of data such as emission levels, traffic congestion and energy consumption allows residents, policy makers and politicians to develop and/or implement smart, preferably real-time responses to problems residents are faced with [1] [2]. The metaphor of a smart city can be interpreted in various ways with various perspectives. One of those perspectives is that increased availability of data allows for more rationalized decision-making and the use of big data algorithms to support or even automate some aspects of decision making, which is exemplified in the rising popularity of all kinds of dashboards (either or not located in cockpit-like headquarters) with which key measures of relevant urban developments are visualized [3]. A second perspective is that it is increasingly possible to 'crowdsource' relevant development using sensors that are owned by a variety of resident groups, allowing for a much more in-

clusive form of city governance; for instance, residents can use mobile devices to capture and share images of defunct public infrastructures, thereby contributing to a more citizen-centric form of urban governance.

Recently, disaster management practices were discussed in the context of the smart city metaphor [5], [6], thus highlighting the role of networks linking all kinds of sensors (including residents' mobile social media applications) and dashboards for the purposes of disaster recovery. This paper focuses on the Indonesian city of Bandung's responses to seasonal floods, and especially on the implementation and use of social media channels as a medium to inform the disaster management operations. The research question is: what role do social media play in the government response to Bandung floods, and how can this role be explained?

The answer to this research question necessitates an empirical, inductive approach with which actual practices are observed and analyzed from the ground level. The remainder of this paper, therefore, presents an analysis of both secondary (online) data scraped from Bandung-based social media accounts in which eyewitness accounts, questions and requests for assistance were communicated, as well as primary interviews data, and data gathered during fieldwork conducted by one of the researchers in Bandung.

## **2 Smart City, Disaster Management and Social Media**

Scholars have addressed a broad variety of definitions of a smart city, without converging to a consensus yet. In ongoing debates, the focus is actually circling around technology innovation, underlining governance approaches in urban development, and the role of social capital herein [4]. This means that in addition to the integration of sophisticated information and communication technologies (ICTs), the role of society in their continuous interaction with various city actors including government is the key element of the concept of the smart city. Thus, one of the main foci of smart cities as a topic of study and debates is how to promote innovative governance network through smart urban collaboration [1].

In practice, smart cities are becoming a very common trend in urban development over the world, including in Indonesia. The level of resilience of smart cities has become the focus of scholars' research endeavors. One notable line of research is related to smart cities' capability of responding to unexpected predicaments such as natural disasters; smartness in urban governance is considered to have the potential to increase resilience. In the context of smart cities, however, various priorities exist and crisis response and resilience in practice competes with economic development, development of technological infrastructures, and the enhancement of multi-stakeholder partnerships. [5].

A 'centralized intelligence'-connotation of the metaphor of a smart city highlights the use of, for instance, meteorological sensors, satellite imaging and computational models to adequately predict river flows and possible floods [6], [7], thereby potentially improving the ability of emergency services to effectively allocate scarce resources to

disaster management operations. Researchers have also argued that citizens' spontaneous social media activities are a valuable source of data for emergency services [8], especially for purposes of mapping and rapid assessment [11]–[16], and some studies have proposed mathematical models that use social media messages as inputs to predict streamflow and flood conditions [9]. Social media is considered to be the accessible and promising real time sensing tool in facilitating people participation in smart city management [10].

However advanced existing model-based approaches to alleviate disasters may be, the crowdsourcing of data at the ground level (implying 'crowdsourced participation') results in many obstacles. Academic literatures have reported limited and/or unequal social media reach, officials' doubts about credibility of social media reports, resource constraints from the side of emergency services, and privacy and security issues as prime obstacles to the use of social media in disaster management [11], [12], [13].

In the analysis of social media adoption and use in the context of the Bandung City authorities' response to seasonal floods, we draw concepts selected from the literature mentioned above relevant to our investigation. These literatures sensitize us to various possible obstacles in various perspectives on the concept of 'smart cities'. However, a rigorous explanatory framework of relevant antecedents, conditions and/or implications of social media use for disaster management is lacking. Moreover, it is likely that such an explanation should take local contexts (including but not limited to a country's or city's development classification) into account. Therefore, we designed an interpretative case study to construct a set of patterns with which social media's role in disaster management practices are illuminated and theorized about.

### **3 Context and Methods**

This study is an inductive, qualitative study of the role of social media in disaster management (particularly dealing with seasonal floods) in Bandung Indonesia, a city that has received recognition as one of the more advanced 'smart cities' in South-East Asia. Over half of Bandung's population aged above five years old is an active Internet user, and Bandung's city administration and internal management practices have revolved around e-government programs, e-budgeting and performance management systems for work units and civil servants.

Bandung has invested heavily in measures with which its city government can monitor all forms of city events and disruptions related to traffic, weather conditions, floods and crime. Under the leadership of its mayor Ridwan Kamil (mayor from 2013 – 2018), Bandung was the first Indonesian city to acquire a Command Centre, with which CCTV feeds and social media feeds were to be integrated in visualizations of traffic congestion and natural disasters. The Command Centre is supposed to be the main control center for all information that relevant and useful for decision-making.

The City of Bandung is subject to impact of seasonal floods, and this study focuses on events and developments during the floods of March 20, 2018, November 26, 2018, and January 13, 2019, all of which were extensively covered in national and local media and discussed on social media. All the floods were classified as flash floods, in the

sense that floods were triggered by high rainfall intensities that caused water absorption areas and reservoirs not being able anymore to accommodate large volumes of water. These floods have been compounded by the condition of urban drainage, which has not been able to flow the water properly. This was exacerbated by garbage that had been piled up, and also by the inadequacy of the infrastructure. The people of Bandung often call this form of flood as "Cileuncang Flood."

This empirical study involves data triangulation, making use of interview transcripts, observations, relevant documents and social media accounts. Interviews have been conducted with officials or employees related to the social media services of Public Works Service, Health Service, and Fire Brigade and Disaster Mitigation Service. The other informants are officials and employees from Bandung Command Centre (BCC) under the Communication and Information Service, officials and volunteers at the Indonesian Red Cross (PMI) of Bandung City, managers of a local media, and representatives of (Quick Response Team) TCT Bandung.

For the study of social media, the GetOldTweets, a Python-based application developed by Github was used to capture contents and meta data (time of publishing, message interactions) of Twitter social media messages (from one week prior to the flood up to a week after the flood), using 'Banjir' and 'Bandung' as search terms. Additionally, Gephi was used to analyze and create network graphs.

From all private, NGO, government, mass media and individual officials' accounts studied, conversations were categorized in topics like complaints, suggestions / ideas, assistance requests, updates, and government response. This categorization is developed on the basis of the main topic of the Twitter posts, and the categorization's labeling is tailored in accordance with a number of previous studies [14]–[16].

Data analysis proceeded iteratively between examinations of data and development of explanatory patterns. Prior research briefly mentioned in section two informed the analysis but a variety of new insights were considered as the analysis continued. Inductive reasoning facilitated the discovery of new theoretical themes and patterns, which eventually coalesced into explanatory statements regarding the role of social media in the government response to Bandung floods. As the process of the analysis of data provided multiple occasions to review the plausibility and consistency of the logic underlying interpretations, the eventual findings and conclusions meet the established criteria for the credibility and authenticity of qualitative, inductive research.

## **4 Results and Discussion**

### **4.1 Description of Social Media Use During Urban Floods**

From the social media scraping, 540 Twitter conversations related to the 20 March 2018 flood were obtained, 484 conversations for the 26 November 2018 flood, and 434 conversations related to 13 January 2019 flood. Not all of these conversations were deemed relevant: some conversations were related to Bandung Regency not Bandung City, and some use the word 'flood' yet in a different context (such as in online marketing efforts for products or services that utilizes a conversation that is being talked about). After filtering, 1497 relevant conversations related to the 20 March 2018 flood were found,

406 related to floods on 26 November 2018, and 211 related to floods on 13 January 2019 (see Table 1).

**Table 1.** Issue and Issuer Classification

<i><b>Flood Events</b></i>	<i>Number of relevant Tweets</i>	<i>Topics</i>	<i>Type of Issuer Account</i>				
			Private	NGO	Officials	Government	Media
<i>20 March 2018</i>	1497	Complaint	171	1	1	0	27
		Suggestion	137	6	5	2	126
		Request	43	5	0	0	12
		Update	378	23	2	14	418
		Government Response	145	7	2	27	96
<i>26 November 2018</i>	406	Complaint	76	0	0	0	2
		Suggestion	73	0	0	3	37
		Request	13	0	0	0	0
		Update	73	4	0	5	110
		Government Response	3	1	0	18	16
<i>13 January 2019</i>	211	Complaint	44	0	0	0	2
		Suggestion	23	1	1	0	6
		Request	5	0	0	0	0
		Update	70	2	1	2	40
		Government Response	4	1	2	2	16

In general, based on data scraping, a number of observations need elaboration. First, in all three events, updates are the most frequent type of messages, with instances being rain intensity, water inundation level, traffic jams, impacted locations, cover-age of locations that were being assisted, and reports on the progress or results of flood responds. Arguably, citizens use social media to raise awareness among fellow citizens or relevant authorities. Traditional media accounts frequently retweet these kinds of messages, giving updates an even bigger outreach.

Second, especially on private accounts, complaints were relatively frequent, which included frustration and sarcasm that questioning the government's performance. It must be noted here that the three floods intersected with the elections for the position of governor of West Java, with Bandung's mayor Ridwan Kamil being one of the candidates.

Third, many 'suggestions' originated in NGOs and expert communities and relate to issues such as reduced water absorption capacity in the North Bandung area. The opinions covered by the media criticized politicians' promises to fix the North Bandung area problems.

Fourth, government accounts were likely to disseminate and document governments' response to floods, such as reports of Health Services' visits to affected areas and Public Works' activities related to fixing clogged waterways, and CCTV-sourced images of puddles, traffic congestion and strong winds. These posts were accompanied by safety messages to the public.

## 4.2 Themes and patterns on social media implementation and use

Overall, the interpretation is that social media is used to a limited degree in relation to flood disaster management operations. Based on analysis of media reports, documents, interview transcripts and observations, a number of themes underlying this observation could be noted that – individually, as well as in combination – provide an explanation for the limited use of social media, which may be interpreted as a stark contrast with the ‘smart city’-clamor that is so vividly present in Bandung city’s policy talk. The themes are presented below.

### **Theme 1: Fragile Adoption of Bandung Command Center**

During Ridwan Kamil’s reign as mayor of Bandung, the Command Center was used for social media analysis. The city acquired funds and invested in a partnership with Mediawave, a third party supplier of social media text analysis and mapping soft-ware which enabled sentiment analyses as per geographic region.

A change of political leadership in 2018 led to a change of priorities and the more or less advanced analyses of social media were discontinued, making way for a much simpler analysis of social media activity with more informal reactions to signals on social media. Citizens’ reports and complaints were from 2018 on only accepted when citizens explicitly tagged government’s social media accounts. As one respondent who is associated with the Command Center stated:

*“...So, the job of the operator is also to monitors Twitter, because there are also complaints delivered via Twitter. But there are people who cc (tag / mention), and some are not. For people who do marking/tagging (BCC Twitter account), we can simply see it in the notification. For those who don't, it's a hassle” (Furqon, BCC)*

From the data, it became clear that the adoption of the Command Center and implementation of the advances social media monitoring features bore heavily on the then-mayor’s Smart City vision, with no efforts put into place to provide more sustainable funding and legal foundation for technology adoption. In this context this demonstrates the fragility of technology adoption were support for specific uses of technologies is heavily dependent on individual (and temporal) support by top leaders, with no institutionalization of that support in more enduring financial and coordinative organizational structures.

### **Theme 2: Lack of Government Social Media Presence**

Although under the heading of Bandung’s ‘Smart City’ initiative, social media were strongly promoted throughout various units, it is believed that the adoption of social media in agencies like Public Work Service, Social Service, Fire Brigade and Disaster Mitigation unit including BCC evolved rather informally and organically, with agencies setting up and using accounts according to local customs, rules and practices. Arguably as a result, it proved hard for the public to find relevant information disseminated through these channels of communication, and Bandung city government accounts do not appear as popular accounts marked by the public in their posts during

flood events. Contents related to recent updates and expressions of complaints about the impact of flood as the top two dominant topic categories were not directed to government social media accounts.

**Table 2.** Top-10 Most Mentioned Accounts

NO	20 MARCH 2018			26 NOVEMBER 2018			13 JANUARY 2019		
	Accounts	In-de-gree	Out-de-gree	Accounts	In-de-gree	Out-de-gree	Accounts	In-de-gree	Out-de-gree
1	youtube	44	0	prfmnews	11	5	rid-wankamil	12	0
2.	rid-wankamil	17	0	ridwankamil	8	0	youtube	10	0
3.	pembdg	12	0	youtube	7	0	polres_	8	0
4.	hu-masbdg	10	7	infobdg	5	3	radi-oelshinta	4	6
5.	bandung	7	0	dpukotabandung	5	7	prfmnews	4	1
6.	prfmnews	6	2	dadamartapura	4	2	elshintabandung	3	0
7.	aagym	6	0	tct_	4	0	odedmd	2	0
8.	bdg	5	0	lewatmana	3	9	na_nurularifin	2	0
9.	dinsos_	5	0	chandra_p36	2	1	vimuthia	1	3
10.	diskom-infobdg	5	0	radioelshinta	2	2	tmcresbdg	1	1

The only government-owned Twitter account that is often targeted by the public was @dpukotabandung during the November 2018 floods, as one of the causes of the floods was a defunct water management infrastructure for which the Public Works Service unit behind @dpukatabandung was responsible.

Interestingly, other government accounts such as @pembdg, @humasbdg, which also appeared as frequently mentioned accounts, especially during the 2018 March flood, were not targeted with complaints, but these accounts were mostly mentioned by other government accounts, particularly village and sub-district office accounts. The accounts of village and sub-district report virtually the local activities of their respective areas to the @humasbdg and @pembdg accounts which belong to the public relations unit and the regional secretariat which are hierarchically higher agencies (see Fig. 1 and Fig. 2). It turns out that this social media behavior is part of the obligations of the Bandung city government organization, where village and sub-district are required to report their activities virtually, one of which is via social media that aim to promote transparency.

This obligation turns out to create the opportunity of dishonest practices in reporting government activities. This is because one of the performance assessments of the village and sub district governments, is assessed by their social media posts. The problem is not every time there are events that require a response from the village and sub-district in the form of activities that can be covered on social media. So that the practice of re-uploading photos of old activities is one of the dishonest strategies of social media managers to overcome their obligations.



Fig. 1. Closer look of @pembdgd account in-degree network graph on 20 March 2018 flood



Fig. 2. Closer look of @humasbdg account in-degree network graph on 20 March 2018 flood

### Theme 3: Traditional Media as Intermediaries

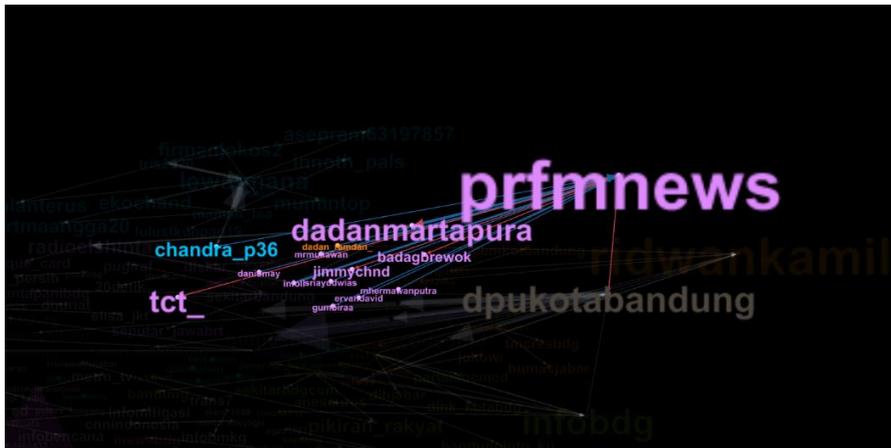
Above, it was concluded that although many Bandung municipal units did have social media accounts, their online presence was hardly noted by the general public. Instead, Bandung's residents used Twitter as an alternative means of emergency communication when urban floods occurred, and residents seemed to prefer mentioning local media accounts such as @prfmnews, @infobdg, @Radioelshinta, @elshintabandung (the local version of Elshinta), when they share their contents related to flood (see Table 2). This behavior is thought to be a catalyst for local media to grow as an intermediary for issuing complaints and sharing updates. Another factor that is also strongly suspected of driving this activity is the more dynamic social media approach performed by PRFMnews. Admin PRFMnews will reward a sign of recognition to every post that mentions them. In addition, if community posts are related to urban issues, the admin will try to crosscheck the fact by replying the posts and then forward the post by mentioning relevant government accounts through Twitter. This bridging hub role can be seen in the Twitter communication network, especially regarding the November 2018 floods as seen in Figure 3. **Error! Reference source not found.**

PRFMNews emphasizes its efforts in bridging residents' concerns to relevant stakeholders and simultaneously building intimacy with the community:

*"...now, Twitter penetration is faster than other social media accounts, why is that, because we deploy one person, every eight hours. So for social media (management),*

*there are two shifts minimum. The focus is receiving all reports from citizens via Twitter, mentions, DMs (Direct messages) and etc. Later, we will follow up (the reports) with related agencies. That's what makes it (PRFM Twitter growth) so fast. ... Once we get the (floods) report we won't wait long. We directly forward to the relevant party such as Public works Service or Fire Brigade and Disaster Mitigation Service, since here in Bandung there is no regional disaster mitigation unit" (Rifki, PRFM News).*

The social media managers for government accounts were aware of the popularity of this local media organization. So, when urban flood occurs, social media managers for government accounts selected the PRFM account as one of the most up-to-date sources of information. As previously described, this information monitoring was done manually, or in "lurking mode", which means the government social media managers monitors the developments of information and current situation through popular media Twitter accounts.



**Fig. 3.** Closer look of @PRFMNews account in-degree network graph on 26 November 2018 flood

#### **Theme 4: Mutual Distrust Between Government and Citizens**

In discussing social media's role in crisis communication, the issue of quality of information and trust therein has been given ample attention [17]. The volume (or even overload) of information exchange on social media has, in the case of Bandung, increased local government's concern about the emergence of fake news, with the Public Work Service unit seemingly being able to better cope with this phenomenon than other units. For instance, The Fire Brigade and Disaster Mitigation Service, which is the leading sector in disaster management in Bandung City, only uses social media according to its rather strict Standard Operating Procedures (SOPs) to distribute information, and chooses not to use social media as a source of relevant information as it fears being deceived by false information, as one of respondents from Fire Brigade and Disaster Mitigation stated:

*“...Social media is quite helpful for us when dealing with disasters. But there are also negative sides like hoaxes, such as photos or videos that were shared not at the time of the incident... So, our SOP in carrying out disaster management is through telephone... Because, we can directly provide feedback with the reporter, it can be recorded, and the person in charge with the incidents report is clearer.”* (Robby, Fire Brigade and Disaster Mitigation of Bandung City)

On the other hand, this study also found a tendency for members of local communities to distrust the government. One of the indications found in this study is the growing popularity of local media as a source for government information, rather than using official or semi-official government information. As explained above, the citizens prefer to submit their reports to local media in the hope that these reports can be amplified and put a pressure to the government. The lack of the government's ability to build interaction and engagement arguably negatively impacts citizens' trust in government. Various scholars have argued that the more often virtual interactions are developed, the higher citizens' trust in government could be [18], [19]. This shows the government's failure to manage social media, because, in an emergency situation, government institutions should ideally be the primary sources for people's hopes, because government agencies are considered to be the most resourceful institutions to deal with the impact of disasters [20].

## **5 Conclusion**

This paper reported on the role of social media in the context of disaster management operations in one of South-East Asia's most prominent 'Smart City', Bandung. In the rhetoric of Smart City strategies, social media play an important role as a medium for crowdsourcing, which enables citizens to speak up in a more inclusive participative governance approach. The Bandung City Government seems to be trying to take advantage of people's knowledge of what the community actually experiences by implementing social media. The empirical data, gathered and analyzed using qualitative methods, demonstrate a limited role for social media, due to a number of reasons that in combination provide an explanation for the limited role of social media (1) fragile implementation of a Command Center that was heavily dependent on the temporal political leadership (2) diffusion of social media use throughout the City government's agencies and units, where use of social media is characterized by local enthusiasm, and driven by local rules, conventions and practices, but institutionalization is lagging behind, (3) emergence of traditional media that embrace social media to build intimate relationships with residents and act as alternative channels of communication between citizens and government units and (4) an overall lack of government officials' trust in the authenticity and sincerity of residents speaking up on social media about issues they are confronted with and a lack of citizens' trust in government's willingness to take their communication seriously and act responsively.

From the empirical data, alternative government use of social media could be observed. For instance, social media are used internally by government units to enforce

transparency [21] and reporting on social media by government units takes place to conform to performance indicators instead of responding to citizens' needs or requests.

Overall, this paper shows the quirks and challenges of implementing compelling 'smart city' rhetoric applied to disaster management practices in the specific context of Bandung City, where a relatively new technology results in somewhat surprising and unanticipated uses that are both enabled and arguably amplified by the local context in which innovation takes place.

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