



Crisis Informatics: A Systematic Evaluation

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Abstract: Crisis management and communication are increasingly being challenged by the impact of social media as a forum for crisis communication. Among the many roles that crisis management services embrace, managing outreach information and communication are increasingly important. This study presents a systematic review of articles pertaining to the application of social media to support crisis management. Our review presents that, Situational Crisis Communication Theory (SCCT) is the most dominant theory for crisis communication and twitter is the dominant social network site. Also, the review identifies decision-making, community resilience, privacy issues, information sharing and seeking, social media based crisis communication for future studies.

Keywords: Social media, crisis informatics, crisis communication, crisis management

I. INTRODUCTION

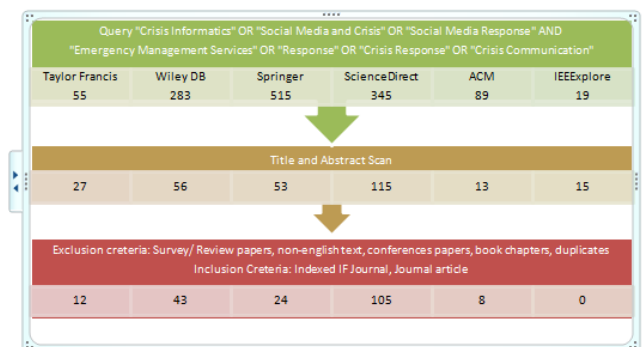
With recent technological advancement, social media is nowadays a part of everyday life (Reuter & Kaufhold, 2018). People tend to use social media platforms (Facebook, WeChat, twittered) to share the crisis situations of oneself or loves ones. The use of social media for these kinds of activities has been referred to as crisis informatics. Reuter & Kaufhold (2018) emphasized that crisis informatics is sometimes the summative term used to describe the use of social media in emergencies which has become a big research field. This paper reviews the related work in crisis informatics. It explores the various information system and technology used in crisis management. A brief overview of models and theories of social media involvement are provided. The paper then identifies ‘emergent’ and ‘extending’ challenges for future research.

This study conducts a systematic literature review to identify the use of social media in crisis (figure 1). Five questions criteria were formulated for article evaluation (Kitchen ham and Charles (2017) cited in Ahmed et al. (2018)); addressed social media use in crisis (crisis informatics), the context is related, methodology adequately

described, data collection is clearly explained, and data analysis approach was accurately evaluated; in order to find the applications of social media use in crisis management. Also papers relevance was considered, the articles were ranked (Nidhra et al., 2012) based on highly related, related, slightly related, and not related; equivalent to 3, 2, 1, and 0 respectively (Ahmed et al., 2018).

II. CRISIS INFORMATICS MANAGEMENT OVERVIEW

Many studies have reported a concrete used of social media in crisis and are essential tools for effective crisis communication (Soehner et al., 2017). Social media use in crisis informatics is not limited to mobilization of digital volunteers, information sharing and real time reporting. Youths use social media to challenge government policy (Iwilade, 2013). Collective sense-making is also generated and use for decision making by authorities. Recently, Facebook research provides support for new and innovative research in the area of crisis informatics to make social media tools more useful to people responding to or impacted by a disaster (Facebook-research, 2018). Figure 2 present crisis management and communication in social media.



Full-text Reading = 193 – 141 = 52

Fig. 1 Literature Review Search and Selection Process

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Table. 1 Models and Theories of Crisis Management and Communication

Reference	Model/ Theory	Improvement/ Implementation	Literature Evidence	Comments
Coombs et al. (2007; 2012; 2018)	Coombs' SCCT	Inclusion and distance strategy based on Attribution Theory	Jiang et al. (2015)	Stakeholders response
		Interactive CC Model	Cheng (2016; 2018)	Synthesize SCCT and SMCM: Awareness and response
Liu et al. (2011)	SMCC Model	Situational Awareness Framework:	Valecha (2019)	Awareness and response
		Social Mediated Disaster Resilience (SMDR) based on 3Rs (Robust, Rapid and Redundant):	Moller et al. (2018)	Social media effectiveness to improve resilience
		Interactive CC Model	Cheng (2016; 2018)	Synthesize SCCT and SMCM:
Huang et al. (2017)	Drift Diffusion Theory	Network Theory: To identify stakeholders involves in a crisis issue	Hellsten et al. (2019)	Network analysis
		Users tendency for reporting safety.	Huang et al. (2017)	Reporting tendency for public safety
Stewart & Wilson (2015)	STREMI	Social sensing audience: response and monitoring	Stewart & Wilson, (2016)	Dynamic based for social media
Zheng et al. (2018)	Spiral Silence Theory	Alternative theory for public response		Public crisis response behaviour
Tan et al. (2019)	CONSOLE Framework	Adopted SPIKES and COMFORT models		Communicate bad news

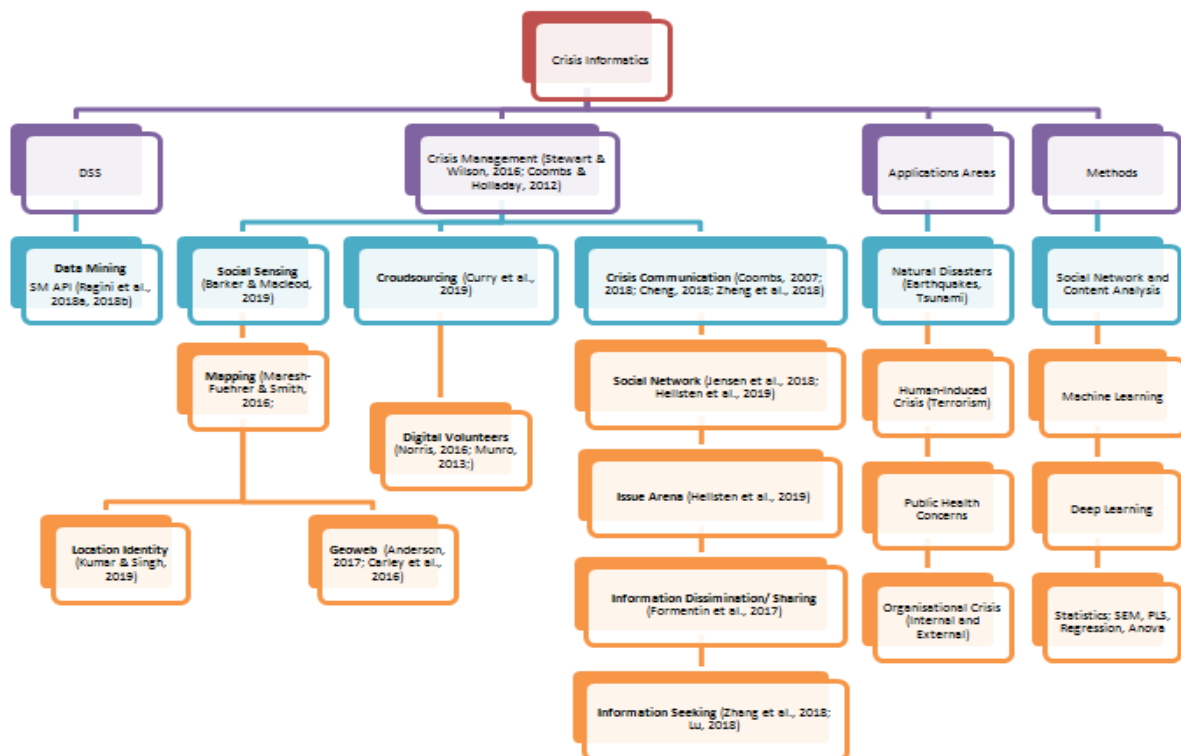


Fig. 2 Crisis Informatics Management; the main classifications were identified based on the articles reviewed. The citation does not reflect the actual articles reported in the figure, other articles are overlooked for clarity purposes

III.THEORETICAL MODELS

The theoretical foundation of researches towards information systems in understanding the acceptance factors of social media used for both the citizens and authority has been identified in the literature. Emphasis was based on the use of social media before, during and after emergencies. Most of the researches are conducted based on the dominant Situational Crisis Communication Theory (Coombs, 2018). Other theories were adopted from various fields to cope with challenges facing crisis informatics as can be seen in table 1.

IV.OPEN QUESTIONS

Rationale for Crisis Informatics Models Improvement

Situational crisis communication theory (SCCT) was adapted to find out how male and female crisis communication differs (Maioreescu, 2016). Coomb's SCCT is efficient when predicting effective crisis responses strategy (Gonzalez-Herrero & Smith, 2008) and for natural disasters (Kriyantono, 2012). The SCCT make more emphasis on the message, it a traditional, and cannot provide dynamic solutions needed by the social media (Stewart & Wilson, 2016). SMCC was proposed to solve the weakness of SCCT models with respect to the new media (Social media) and recently for community resilience (Moller et al., 2018).

A Tool for Decision-Making

Ragini et al. (2018a, 2018b) has recently shows how social media can be effective in decision making. The paper used sentiment analysis, categorize and classify social media data to better decision making during response and recovery phase of disaster (Ragini et al., 2018a). The other paper proposed hybrid method for mining crisis information to detect people at risk (Ragini et al., 2018b). Moreover, a framework that manage information for decision making (Cheong & Lee, 2011), the impact of big data from social media (Watson et al., 2017), and how uncertainty are communicated and the effects of social positions on collective sense making (Stieglitz et al., 2018) has been proposed.

Social Media for Crisis Communication

Publics are far from being passive receivers, all thank to social media; they actively seek out crisis information and exchange views with others (Ji & Kim, 2019). Friends and relatives are used effectively as trusted source (Andreastuti et al., 2018) of crises related information. Individual's takes warning message more seriously when the social position of the person sharing the message is close to their own (Vihalemm et al., 2012). "Crisis communication cannot be complete without a discussion of the rise and impending dominance of alternatives forms of communication such as social media and the likes" (Soehner et al., 2017). Social media should be treated as a forum for crisis communication (Iannarino et al., 2015). Among the many roles that crisis management services embraces, managing outreach information and communication are increasingly important. Best way to effectively communicate different crises (Coombs, 2018) on social media is lacking from the

literature and communication is an integral part for decision making (Palttala et al., 2012).

Other Challenges

Machine Learning Involvement can be an effective tool for crowd sourcing, digital volunteerism and in identifying user location (Stieglitz et al., 2018; Ragini et al., 2018a; 2018b). Best way to manage a crisis is to prevent one (Coombs & Holladay, 2012), but this can only be applicable for human-induced crises, public health related crises or organizational crises. Also, the use of social media is affected by the privacy and information sharing values of the users and that of the crisis managers that seek to use social media (Watson & Rodriguez, 2018). Moreover, a limitation of many studies is the potential for selection bias of social networking sites. Facebook is more popular accounting for 2.271 billion users compare to twitters' 326 million users (Statistica, 2019), but twitter has received almost 500 times as much attention at it deserves (Munro, 2013). Facebook is more useful tool for crisis than twitter (Eriksson and Olsson, 2016).

V.CONCLUSIONS

The analysis of the existing literature and descriptions of several examples have shown the current usage and future potential of social media for crisis management. Critical assessments are provided with useful crisis management research to researchers willing to exploit social media for crisis management. The review report has identified and discussed several questions and areas for future research. Different application of studies in this area has proved that research from the academia and industry is lacking to address issues and challenges currently facing crisis informatics.

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