The Role of Social Media on Crisis Preparedness and Responses

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Abstract—This study proposed a framework to enhance organizational uses of social media in crisis management particularly in preparedness and responses to crisis. The study discussed four major ways in which social media can be used in the crisis preparedness and response including information dissemination, planning and training, problem solving and decision- making and information gathering. The framework can be utilized to creat social media (SM) tools and to formulate crisis social media implementation processes. Crisis social media users in the framework include communities, organizations, government, individuals and media channels. The study illustarted that SM can be used for community engagement for crisis management by using a complementary mix of different social media. Suggestions on how the framework can inform future crisis SM development and research are provide and discussed.

Index Terms— Crisis, crisis preparedness, crisis responses, Framework, social media.

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1 INTRODUCTION

S OCIAL media plays major rule on the way we communicate and manage events. Social media (SM) is a web-based platforms and services allow users to develop public profiles and connect them with other users' profiles [1]. SM can be accessed by several devices, including desktop or laptop computers, Tablets and smartphones. The most commonly used platforms of social media are blogs, forums, social networking sites, digital content platforms, social gamming and social networking sites. An example of the active social media are Blogger, Twitter, WordPress, Quora, Reddit, Flickr, Instagram, Pinterest, YouTube, Gree, Mobage, Zynga, Facebook, Google+, LinkedIn, Mixi and Orkut, Snapchat, and Wechat [1]. Facebook and Twitter are used by global community whereas others are region specific. All SM platforms traditionally used to connect with new people to maintain existing social ties [2]. These types of networks are highly effective in crisis management as they are widespread in nature and allow the dissemination of information in the form of data, rich multimedia including the narratives such as the videos and photos. Crisis can be defined as the event that is expected to lead to a dangerous or an unstable situation that may affect the community, society or a group[3]. Crisis could be a negative changes in the economic, security, political, environmental and societal affairs especially in case they occur unexpectedly. It is one of the crucial organizational functions that involve planning and dynamic responses to the situations that are unfolded in unpredictable ways. The cascading effects associated with a crisis can severely affect the ability of an organization or a country to operate effectively along with causing harm to structures, people, reputation and assets. It's therefore, a plessant advantages to use social media in order to help managing crisis that could harm organization and people.

The largest social media nowadays is Facebook with more than 2.23 billion users monthly, (Facebook, 2018). The Facebook facilitates the communications in many aspects in which affected people by crisis/disaster can share their ideas, interests, preference and information. Affected people can easily publish their contents, share images, videos, like others' posts, pages and easily follow pages.

Twitter comes after Facebook with approximately 335 million users monthly (Twitter, 2018). Twitter allowed people to post contents with up to 140 characters. The Twitter network is build based on following others or by establishing owns' network. In twitter users usually marks their posts with hashtags to identify their messages and help other to understand and share with them the messages, in this case the occurrence of any crisis/disaster. The information in twitter can be redistributed using re-twitts, a process used to pass or replicate used published information. Twitter provide users with an application to perform search according to their posts in the form of hashtags. The search process usually conducted by an application programming interface but with restricted entities. The obtained data from Facebook and Twitter can be visualized and analyzed using several tools available on the internet. According to recent survey, the user of Facebook forms 65%, Instagram 7%, Linkedin 5%, Pinterest 5%, Google+ 4%, Twitter 4%, Snapchat 4%, others 4%,None 1% [4]. Social networks' information exchange supports the persistence forms of communications that emerge during or after an onset of a crisis or disaster [5]. The word persistency refers to communications that are visible, recordable, and/or transferable to other people over time.

Incorporating the social media in different communication

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strategies and the public safety strategies is highly effective. Organizations can leverage the power of information sharing to enhance the efforts and efficiency in all the phases of crisis such as the crisis preparedness and crisis response. During the phase of crisis preparedness, the focus is particularly on the preventive activities that can help in reducing the risks that result in a crisis. All the crisis cannot be averted and therefore, there should be an equal focus on each the phases of crisis planning, training and management as well as crisis response. The focus in response phase is on the effectiveness and speed of the initial response. There is a need of situation awareness that can keep the authorities aware and authorities can respond effectively when the crisis occurs. The use of social media tools is critical in all the phases so as to engage the community network for gathering, analyzing and disseminating the information timely. Planning and support is however required in the crisis recovery phase so as to restore the situation back to normal. This study discussed the use of SM in preparedness and responses for major purposes in information dissemination, disaster planning and training, problem solving and decision making, and information gathering.

2 THE BENEFITS OF SOCIAL MEDIA ON MANAGING CRISIS: SUCCESSFUL EVENTS

Social media has gained much reputation in the modern societies and has transformed the way we live and do our business [6, 7]. Social media have been successfully used in many crisis management cases, for example, health care, earthquake and tsunami, and flash-flooding. SM has successfully reported many health cases, such as the accurately traced cholera outbreak in Haiti, H1N1 pandemic, and the dengue in Thailand and Indonesia [3, 8, 9].

During the 2011 earthquake and tsunami in Japan, social media played very important rule in alerting public and detecting the emergency locations with accurate localized maps [10]. Similarly, during the earthquakes at Haitian 2010 the US government mainly relied on social media and workspaces to share and manage knowledge contents within agencies [11]. A huge numbers of tweets were posted after the occurrence of Haiti earthquake with approximately 3.3 million tweets and more than 20 million tweets in 2013 following the Boston Bombin and with approximately 5.8 million tweets following the Typhon Haiyan in 2013 respectively [12-15]. These tweets were able to alert public and helped in localizing the emergency events by drawing mapps.

Quick responses from the University of Canterbury platform during the 7.1 magnitude massive earthquake that struck the Canterbury region of New Zeland was coordinated using the University website and the Facebook platform [16]. The University website and the Facebook platform became a prominent sources to support the emergency for several months. This illustrates how the university effectively utilized these environments and their impact within the wider university community. It also indicated that, social media can effectively support information sharing, communication and collaboration in higher education contexts, particularly in times of crisis [16].

Another example is the Emilia-Romagna and Lombardy 2012 damaging earthquake that struck northern Italy which was recorded as the second major seismic event affecting the area in 10 days. The damage was hug in which 40 cities were affected and 17 people were killed/died. The damage of the earthquake and its impact to the land were then available online within only 50 minutes time from the occurrence/onset of the event. This confirms the reliability of using social media in crisis responses.

Additionally, during the Flooding in Queensland 2011, the use of Facebook dramatically increased among the public indicating their interest in help and support [17]. Similarly as the case of Facebook, developers did create an on-line monitoring tool to detect sharp increases in the frequency of key words that appear on Twitter and used them to facilitate in the emergency supports [18]. Lastly, the proliferation of crisis camps and their aggregations, crisis commons, has started to promote the more systematic organization of social media for emergency response, on occasion using wikis [19]. All of theses stories indicated that, social media is very helpful and supportive during emergency situation and could help in many aspects during the crisis management.

3 METHODOLOGY

To develop a social media framework for managing preparedness and responses of the crisis, this study began by a comprehensive literature review. Based on the methods of the literature reviews, our search was limited to the journal articles, books, blogs, organization and government reports. The study intended to use the online literature, the official literature and the scientific literature due to the accessibility and cost effectiveness. For each type of searched we employed the terms of: crisis, preparedness, responses, social media, social network, and networking. The search of literature was conducted using Google Search, Google Scholar, MEDLINE, PubMed, PsycINFO, Academic databases, and Communication mass media.

After the search of literature, only related work were examined further. Ultimately, we retained sources that clearly addressed social media and crises management in the form of preparedness and responses. From the literature review, relevant portions of sources were divided into groups to discuss and illustrate each category in the role of social media in preparedness and responses.

4 RESULT AND DISCUSSION

This study started by critical examination of the social media literature to establish a framework based in preparedness and responses to crisis. The reviews focused on individual users, communities, organisations, governments, and news media. All of these forms being addressed in the framework as users and function as crisis social media content producers. Individuals are private citizens who were not using disaster social media as an agent of another entity. Communities are groups of people in the same area sharing expertise, and experiences. Organisations are structured groups of people

that are responding to, affected by, or external to the disaster. Governments are those at the federal, state, and local level and governmental agencies. The media include large or small organisations, blog, newspaper, television and international news organisations.

Social media on preparedness and responses

In the following sections we discussed the literature of social media on crisis management to develop a comprehensive framework of social media on the preparedness and responses to crisis. We discussed four major ways in which social media can be used in managing crisis specifically in the preparedness and response in the form of information dissemination, planning, problem solving and information gathering.

It has been reported that, information dissemination is very important part of crisis preparedness and crisis response. Social media helps in providing the reliable and relevant information to the public quickly so that the public can be better prepared for responding to the crisis. The effectiveness of preparedness is however, dependent on the penetration and reach of the social media across the wide network. For example, the early warning signs of the crisis can be given to the public with the data gathered from different multimedia platforms that are aimed at detailed analysis to a wide audience. Disaster planning helps in improving the final crisis response. In this case, social media is used in planning and training for the crisis response. The focus of planning and training lies on promoting the scenario planning, personnel training along with achieving the collaboration between the agencies of public and private sector involved in the overall process. The role of social media is to provide the guidance, precautions, rules and regulations for responding effectively to a crisis. Therefore, software engineers and disaster crisis relief expert work together to identify the challenges along with the solutions so as to overcome the scenarios of disaster risk and response. In collaborative problem solving and decision making social media helps in crowdsourcing along with facilitating the collaborative decision making and problem solving by integrating the different streams of information from web based and mobile technologies. This helps in filling the information gaps so as to collect analyze and plot the data associated with urgent humanitarian needs during a crisis. In this case, social media helps in growing the database and making the authorities and audience positioned so as to manage the crisis related situations. For example, the information can be used to improve the situational awareness so that both the authorities and audience can make the informed decisions associated with the resource allocation during the crisis. Similarly, information gathering helps in gathering the information that can be used for both the preparedness and response to the crisis. For example, on the scene footage, disaster assessment and citizen journalism and disaster assessment are central for gathering the information. Information gathering facilitates in coordinating the crisis responses. For example: the community platforms are leveraged by the messages, emails and smart phone applications so as to allow the public and authorities to voice the perceptions, concerns and the thoughts associated with on-going developments.

4.1 SOCIAL MEDIA AND PREPAREDNESS

SM serves as a tool for nations in managing the emergency by spreading and entering the information to public. The tools is employed for preparedness enhancement by several improvements such as the connection of daily and real-time information to public, which was delivered on 2009H1N1 pandemic. Following by Alexandria in later, Virginia health department is triggered with regards to the readiness and venue of vaccines, and the in-charged person is then run towards the sites of vaccination [20]. During the emergency, the combination of social tools and preparedness activities can effectively help the nations and related responders in the response of emergency. Even though SM tool is deemed appropriate and effective for its low-cost, broad extend and prior advantage demonstration, but it is not been optimally used by health professionals [21]. The following sub-sections discussed the role of media on crisis preparedness from different perspectives.

4.1.1 Information Categories

The complication of the SM's analysis and processing can be minimized by the assists of public in classifying and sorting the huge information in it. The spreading information of SM consists the update which included of reporter status, broadcaster's link, and impassioned message for whom who have an effect on event and the humoristic messages too. A report showed 14 distinct types of information regard of the event via SM. Among these types of information are personal experience, opinion and interests, jokes, conceren, fear, anxiety, anger, sarcasm, joy, misinformation and questions. Each of the SM's information is possible to be assigned for any categories with its derived details such as direct information of text , analyzed information, as of the temper and reaction of reporter [5]. Other reported [22] that the information division between personal and informative is enough for emergencies. It could be concluded that, any form of these information can deliver a clear message about the event of crisis.

4.1.2 Location Based Information

In reality, the in-charged person of the emergency case should get the immediate information for locating the afflicted population and determine to arrive the affected location in a shortest time. MacEachren et al. [23] reveals that "social media is becoming increasingly geographic" and its application in emergencies had been acknowledged by organizations of academics and emergency. The posts from Tweets and Facebook could produce two vary information of the location, they are Geo-location data and Location-referencing. First information recognize and locate the details either precise or general of the street addresses with intersections; country name and city; highways and the name of venue. Besides that, the second information replace one another with refer to a reference place or point out a location through one landmark. In a case of the absent for both the information as mentioned above, the venue of user's home can be adopted from their

personal profile and assumed to be the published information of the same area itself. It is noticed to be difficult in locating a geographic venue based on language analysis using tweet due to the low-rates of accuracy, therefore, improvement of this problem is needed in further research. The emergency level consist of a vital data for a certain risk on the geo-location because such group of persons might not aware of the incoming at risk entities or locations.

Based on such concern, the crowdsourcing is used in Social mapping platforms to map the whole areas of road, building and damage site. Such map could be employed for enabling the institute response with several benefits such as collaboration promotion, exchange of information, and coordination improvement of mission executions. Studies from Chatfield in 2012 [24] and Vieweg et al. (2010) reported a percentage of 47 and 40 [24, 25] of the users recorded their venue in profile, which evidence the applicability of user allocation in the map. However, a decrement at 0.23% of entire tweets users recording their location is found in a survey [26]. Another report stated that about 16% of entire tweet users are not recorded their position in the personal profile. According to this concern, an information system is being developed for the sake to analyze twitter's information and generate a database with their respective name [27]. Such detail can help emergency responders in verifying the venue of public user independent to the detail of official address.

4.1.3 Information Dissemination

Of a convention model of crisis management, the details are typically conveyed from emergency institutions to public, subsequent to the processes of analysis for obtained responses of twitters/posts [28] and the allocated situational features of Twitter communication, to be used for expanding the standard information categories of emergency management. Based on this point of view, the convention way of the information spreading is changed by the integration of SM tools. The number of information providers and public involvement in such system using the formal and informal sources are increasing nowadays. In typical practice of the information dissemination during the disasters are generally the same through some pathways: 1) observation to user's friend activities or user own reported behavior, 2) action of messaging, 3) enabling the information to be visible for user's fans and followers. A reported by Bird et al. (2012) stated that 97% of respondents communication are directly forwarded their own accessed information of Facebook pages to family and friends [17]. In some cases, the issued report through SM tools is shown to be earlier than new channel [2] and thus made it excellent appliance for information spreading. For example, Facebook had become the main tool for spreading the information to public for the floods in Queensland and Victoria, Australia, at the year of 2011. Moreover, the number of 'likes' to the Queensland Police Service (QPS) in Facebook page is increased exponentially from 17,000 to 100,000 after 24 hours of the flash floods, and further to be increased to be more than 160,000 'likes' after two days of the disaster. Even for the Traditional media channels, such as radio and TV, are relied on the information posted on Facebook within minutes after it was published on the QPS [17] for the broadcasting

news. In spite of that and based on a finding in a different study [29], publics are still preferred to the television for emergency information although SM tools are popular. Based on the finding from literature, SM tools can be used as a conduit for directing people "to official sources of information and amplifying these messages to a broader audience [29].

4.2 SOCIAL MEDIA AND RESPONSES

The research for emergency responders and its applicability in social media is still in its infancy. However, due to several advantages of applying SM tools, people have aware of the future prospective that the group of SM users will be increased significantly [30] for emergency responders. For example of this statement, The London Police has already started to use social media as a communication channel with public during the riots happened in 2008 [31] and 2011 [32]. Other than that, several incidents were recorded to support this statement. Since the 2010 earthquake in Haiti, emergency responders around the world have adopted social media as the main alternative communication channel with the public [12]. Similarly, in 2012, during the hurricane of Sandy, the majority of emergency authorities and responders from the East Coast in the United States adopted SM as the main communication channel with the public. In the Westgate Mall terror attack in 2013 [33], all of the first responder organizations in Kenya use social media as the dominant communication channel with the public during emergencies.

The quick assessment for critical information should be viewed as the high priority [34] affair in order to organize the perfect rescue mission; such information should include the affected area, distribution of damage, locations of the population and potential of the affected areas. Nonetheless, Emergency authorities should identify their published information with a real-time basis although this will eventually delay the arrival time to public. The hierarchical structure of Emergency authorities are normally organized in rank-based approach where the operations are according to a specific "silo" with particular expertise. During the Haiti earthquake in 2010, the US Government and Armed Forces relied solely on organizational SM tools in coordinating knowledge and actions between cooperating response agencies. The traditional risk and crisis communication should be acting as one-way intermediaries from emergency organizations to the public through the news media.

4.2.1 Send and Received Help Assistance

Social media (SM) can be used to declare the precise emergency cases and displayed locations. It is declared to be trustworthy for disaster condition; thus, it is been applied for assisting in disaster postage [35]. A study reported that Twitter had used SM in identifying tweets that were requested for help in the earthquake and tsunami, which happened at the Pacific coast of Tōhoku, Japan, in 2011, Acar and Muraki (2011) [36]. One example from such incident, a message recorded from victim: 'We're on the 7th floor of Inawashiro Hospital, but because of the risen [sic] sea level, we're stuck. Help us!'. With such a case, the SM radio, for example "ARC", is then becoming a useful tool for disaster responder in

determining the tweets' position and help them. Other than that, Community 9993 centres can be used for monitoring the SM networks to confirm the requests of emergency for the help sake. In 2012, a survey to US adults showed that majority of the respondents agree that local and national emergency response organizations should monitor their websites and social media sites for the sake to respond those victim who need help [19].

4.2.2 Inform others about individual's condition and location

In fact, the concern of the safety condition for an individual's family or friend who are trapped in affected area is the most important information to people during the instant disaster. In the case of a critical destruction level of the disaster, victims are needed to register at a certain located spot for the purpose to inform their situation and establish connections with others. As above-mentioned case, SM can be a useful tool to assist such processes. After the incident of Hurricane Katrina, for instance, 'safe lists' are developed in internet sites to include those victims who are safe during the storm.

Another case of mass shooting that was happened in the campus of Virginia Polytechnic Institute and State University (Virginia Tech) in US on 16 April 2007, students were used the method of texting and instant messaging for informing their safety status to others and confirming their friend's condition. Lastly, residents seek the 'assurance of safety' for their family and friends (and property) during the major flood that was happened in Australia at 2011. As an instant solution for the problem as mentioned above, the ARC is currently operating as 'Safe and Well' website for dedicated registered member to follow up the status of any happening disaster.

4.2.3 Provide and receive information about response and recovery

Even after the recedence of disaster, SM can be used for continuing update with the instant efforts that related to disaster and the sharing of personal experience in disaster. SM sites, such as Facebook, are covering and sustaining of disaster news longer than that of traditional mass media. Pennebaker and Harber (1993) had identified a social stage model of disaster coping based on interpersonal communication [37] based on a study of the Loma Prieta earthquake in California in 1989. In such model, the open conversation of victims with others related to the happening disaster is beginning immediate during the disaster and it can be maintained for another few weeks again. Eventually, the inhibition phase where individuals are of interest to discuss the event but not listen from others. This process reduces the incorrect statement from the community's conversation and the goal to reduce the worry of an individual can be accomplished. Online social media could provide users with an opportunity to discuss a disaster during this inhibition phase. Furthermore, SM facilitate the interpersonal communication between victims and disaster responders by expanding the proximity social network to the disaster event. Finally, SM offers a way for citizens to continue in participating the discussion and problem-solving of a tragedy.

5 IMPLICATIONS FOR PRACTICE AND RESEARCH

The proposed framework of social media on crisis management discussed in this study has several implications in the practical and research uses. First, this type of framework showed an excellent way in which social media can be used to inform and improve crisis operation. It provide a chance to organize the crisis SM users and guide their operational plans. It also offers an opportunity in which technical development could increase the integration of SM in crisis operations. Second, the proposed framework provides an outline for future scholarship by determining what characteristics of crisi SM content attract attention, improve learning, encourage individuals to act, evaluate the information, draw structure of social media and determining how to influence social media discussions of events. Future research should focused on specific type of social media platforms and indentify which is better fit on certain crisis uses. This would show that, some social media platforms perform better than others. Additionally, computing devices should be taken in consideration as they relate to the employment and effectiveness of crisis social media. The results of the future studies can be incorporated in the proposed framework to increase the synthesis and usability of the insights gained through ongoing crisis/disaster social media scholarship.

6 CONCLUSION

A framework on the role of social media on crisis management was identified through a comprehensive literature review. The framework mainly focused on the preparedness and responses which served to facilitate the development of crisis management based on social media tools. With an increasing use of technology, people across the world tend to use social media with different means such as the mobile phones or computers. This research indicates that the social media dramatically helps in managing and preparing for the crisis by focusing on the aspects such as Information dissemination, Disaster planning and training, problem solving and decision making and Information gathering. The social media tools can be used by organizations, humanitarian agencies, government etc. so as to support the crisis management especially by focusing on the preparedness and response and recovery plans by sending the warnings and alerts. During and after a crisis/disaster, new ways of utilizing SM tools to collect, share, and disseminate information, were witnessed. With rapid advancement on SM, the framework described here may also evolve over time. Our framework can be adjusted and expanded as necessary to reflect any future technology changes.

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