

# Analysis of Post-Crisis Twitter Communication: A Study of the Iquique, Chile Earthquake

(Full Research Paper)

Ashir Ahmed  
Swinburne University of Technology, Australia  
azahmed@swin.edu.au

Jason Sargent  
Swinburne University of Technology, Australia  
jpsargent@swin.edu.au

## Abstract

*This paper examines the use of Twitter as a communication tool during post-crisis phase of the Iquique Chile Earthquake in 2014. Key questions addressed in this paper include (a) who are the participants (senders and receivers) and (b) what are the communication tasks that are performed by the use of Twitter during post-crisis phase? Ahmed and Sinnappan's (2013) framework is used as a foundation to conduct this study whereby five hundred Tweets spanning five days after the Iquique Earthquake were analysed. The findings of this research suggest the vast majority of Tweets sent during post-crisis phase were focused on sharing information and disseminating alerts and warnings related to aftershocks and subsequent tsunami. Moreover, the individual community members are key participants in the Twitter generated communication. It is anticipated that the findings of this paper will extend our understanding on the key participants and the communication tasks during post-crisis phase.*

## Keywords

Twitter, Communication tasks, Crisis management, Iquique earthquake.

## INTRODUCTION

Over the last few years, growing interest has been witnessed in the use of social media applications in crisis communication (this paper uses the term crisis interchangeably with that of disaster). Further to the practical use of such applications, there is growing number of academic studies that examine various aspects of social media use in crisis management (Veil, Buehner, & Palenchar, 2011). Social media feeds enable its users to contribute and disseminate information in various forms such as text, symbols, pictures, audio or video; which is highly required in disaster communication (Curtis, 2013; Turel & Serenko, 2012). A wide range of studies suggest that social media applications such as Twitter can be very useful in times of crisis by quickly and effectively sharing information and disseminating relevant news (Vieweg, Hughes, Starbird, & Palen, 2010).

Over the last few years, a number of published studies have examined the role of social media applications especially Facebook and Twitter and studied their pros and cons during disastrous situations (Acar & Muraki, 2011; Cheong & Cheong, 2011; Bruns, 2014; Abbassi et. Al, 2012; Gao, 2011; Chatfield, A., & Brajawidagda, 2012). Some examined the technological features of these applications whereas other attempted to explore the use of social media in a particular disaster context. However, there is still a room for comprehensive academic study that not only addresses the pros and cons of a particular social media application but also investigates the key participants and their distinct role in crisis communication (Cameron, Power, Robinson, & Yin, 2012). Furthermore, "due to social media's innovative and ambiguous status as an emergency communication channel, there is uncertainty about various participants' roles during different disaster phases, their expectations and responsibilities regarding the quality of information, their ability to verify data, their authority to provide advice or make decisions related to the urgency of a request, and so on" (Resnyansky, 2014, p. 61).

In the initial work of this paper, one of the authors presented a conceptual framework that laid the foundation for further research around various aspects of crisis communication such as (i) the participants, (ii) the level of interaction among those participants and (iii) the communication tasks that they should perform during crisis Ahmed (2011). Subsequently, Ahmed & Sinnappan (2013) further extended the original work through Community of Practice (CoP) theory and adapted and validated the framework by secondary data collected from Australian newspaper articles on the 2011 Queensland Floods. Although the updated framework presented in

Ahmed & Sinnappan (2013) was validated by the secondary data, it did not address the following questions:

- What are the unique characteristics of a particular social media application such as Twitter or Facebook in crisis communication?
- What are the communications tasks in particular disaster management phases such as before, during or after disasters?

In order to address the above questions, this paper attempts to further extend the author's previous work and validate the existing Ahmed & Sinnappan (2013) framework with primary data collected from a case study of use of Twitter in crisis communication during the 2014 Iquique Earthquake.

The structure of the paper is as follows: the background section provides information on the April 2014 Iquique Earthquake, the use of social media and the framework that is used as a foundation for this research. Details on the data collection and data analysis are followed by a discussion section. Finally, the paper concludes with the statements on the limitations of this research and directions for future research.

## BACKGROUND

After a deadly earthquake in 2010, another mighty 8.2 magnitude earthquake (known as 2014 Iquique Earthquake) struck at 20:46 local time (23:46 UTC) off the coast of Chile on April 1, 2014 with a moment magnitude of 8.2; triggering landslides, cutting power and generating a tsunami (Brownlie-Smith, 2014). Five people were reported dead and the cost of millions of dollars in structural damage. According to Australian Broadcasting Corporation (ABC), the first waves struck Chile's Northern coast within 45 minutes of the quake, with roads left gridlocked as Chileans abandoned their coastal homes for higher ground. The Pacific Tsunami Warning Centre reports the wave has been measured at 2.11 meters at its highest off Iquique – Northern Chile. This crisis drastically affected traditional communication channels such as TV, Radio and newspapers, and led people to rely on alternate (more contemporary) channels such as social media for sending and receiving information related to Iquique Earthquake.

Research suggests social media are “introducing radical changes to disaster and emergency communication. These changes include: an extended range of participants; uncertainty of their roles and power/hierarchy relationships; an increasing quantity of information and uncontrolled quality of messages” (Resnyansky, 2014, p. 62) and that the communication needs of people varies during various phases (such as ‘before’, ‘during’ and ‘after’) of crisis management. During ‘after-crisis’ phase; when people are in panic and struggling to cope up with the devastating situation caused by the disaster, they intend to send short, precise and to-the-point information (by using lean mode of communication) rather than sending very long and detailed information (by using rich mode of communication) (Ahmed, 2012). Aligned with this line of argument, it is believed that Twitter–designed to transmit a rather short (140 characters) message to broader audience–is an appropriate communication during post–crisis phase. In order to examine various aspects such as (i) the participants in the disaster communication, (ii) their level, of interaction and (iii) the communication tasks performed by the use of Twitter, this paper extends the author's existing work and builds on (Ahmed & Sinnappan, 2013) framework as a theoretical foundation for this study. This paper starts with an underlying assumption that the framework presented previously by Ahmed & Sinnappan (2013) is quite generic and may have to be adapted based on the consideration of a particular social media application (Twitter in this case) and considering a specific phase of crisis management (post–crisis phase in this case). The conceptual framework presented by Ahmed & Sinnappan (2013) is given in Figure 1.

Figure 1 below suggests three key participants in disaster communication named as (i) disaster management agencies (referred as A), (ii) business organizations (referred as B) and (iii) individual community members (referred as C). The other aspect presented in the framework is the level of interaction among these participants. Although the above framework suggests the possibility of having one–to–one interaction (such as A–B, A–C, B–C etc.) among various participants; this might not be applicable in the case of Twitter (a message sent on Twitter is broadcasted to multiple audiences simultaneously). Finally, in the context of communication tasks, the framework presented previously makes no distinction among various phases of crisis management life cycle such as ‘before’, ‘during’ and ‘after’ crisis. However, this paper focuses only on the post–crisis phase to study the tasks performed during crisis communication. This change of focus could have an impact on the nature and the significance of various communication tasks.

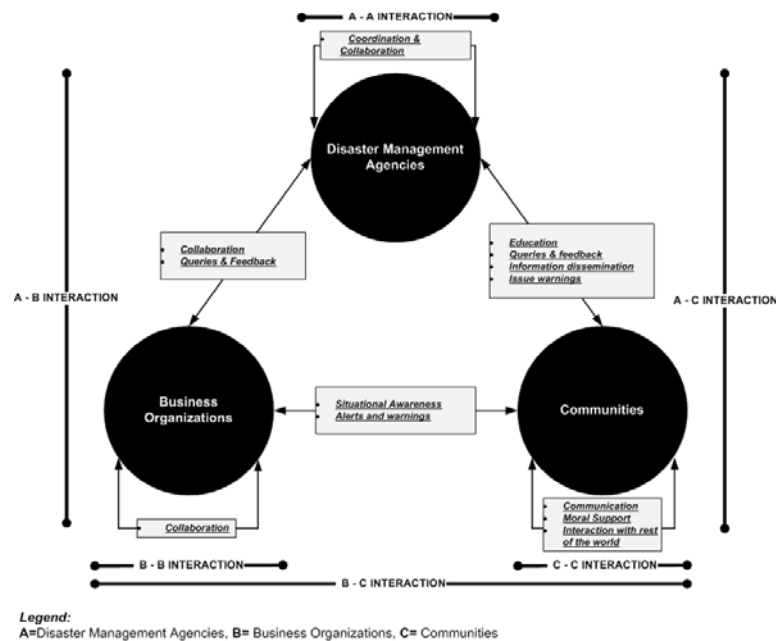


Figure 1: Framework presented by Ahmed and Sinnappan (2013)

Following sections describe the process of data collection, data analysis and findings of the paper.

## DATA COLLECTION AND ANALYSIS

### Instrument for Data Collection

In order to examine the participants and their communication tasks after the Iquique Earthquake, this paper captured original Tweets by using a software-aided program called ContextMiner (available at <http://contextminer.org>). ContextMiner is a framework to collect, analyse and present the contextual information along with the data. It helps to run automated crawls on various social media sources on the Web and collect data as well as contextual information. It also analyses and adds value to collected data and context, and monitors digital objects of interest (Shah, 2014). A ContextMiner campaign (in ContextMiner, 'campaign' refers to some story, concept, or an object on which you wish to collect data) with the title 'Chile Earthquake' was started just after the Iquique Earthquake on April 1, 2014. To cover the vast variety of tweets, an intentional attempt was made to collect all tweets containing 'Chile Earthquake' in common and not just rely only on a particular #hashtag to capture the required tweets. In order to minimize the chances of any misinterpretation, this study includes only those tweets which were sent in English language whereas tweets in other languages such as Spanish and other local languages (e.g. Huilliche, Kakauhua, Kunza and Mapudungun) are not included in this study. The ContextMiner campaign remained open between April 2, 2014 and April 6, 2014 and resulted in 2000 tweets being captured. The 'Twitter\_id', 'Title', 'Link', 'url', 'author', 'authorpage', 'pub\_date', 'pub\_time' and 'rank' were recorded for each of the collected tweets. After an initial review of the collected tweets, a sample of five hundred tweets (first 100 tweets on each of the five days between April 2, 2014 and April 6, 2014) were selected for further analysis

### Data Analysis

The sample of five hundred tweets is analysed by employing the content analysis method. According to Stieglitz & Dang-Xuan (2013), content analysis is a systematic, replicable technique for compressing many words of text into fewer content categories based on explicit rules of coding. In more contemporary terms, content analysis is a research method that uses a set of procedures to make valid inferences from text (Macnamara, 2003). This study performed content analysis on tweets to identify the relevant themes and patterns by using priori coding. Priori coding technique was found very useful to defuse the criticism of content analysis that it often fails the test of objectivity because researchers construct the list of issues as they find them in the data sample. Priori coding design requires that "all decisions on variables, their measurement, and coding rules must be made before the observation begins" (Macnamara, 2003). Priori codes used in this paper are borrowed from author's previous work presented as Ahmed & Sinnappan's (2013) conceptual framework. The following is a summary of steps taken as part of data analysis.

1. Ahmed & Sinnappan (2013) framework is used as the basis for priori coding.
2. In the first phase, dataset of 500 tweets was equally shared between two of the authors of this paper for analysis.
3. Both authors reviewed each of the allocated tweets and assign a code for (i) the sender of the tweet, (ii) the receiver of the tweet and (iii) the actual message of the tweet.
4. 'Author' and 'authorpage' column were used to confirm the identity of the sender.
5. If the authors believed that the priori codes did not match with the sender's, receiver's or message's category, a new code was generated.
6. After completing the first 5 steps, the second phase of data analysis was conducted that swapped around the allocated tweets between the two authors for another round of independent analysis. The objective of this phase was to reduce bias in the coding process.
7. In the third phase, the coding was reviewed by both authors together. This phase was aimed to remove any inconsistency in the coding process.

## RESULTS

### Participants of the Communication Process

In his previous work, Ahmed (2011) suggested three key participants of the communication process (as referred as disaster management agencies (A), business organizations (B) and community members (C)) when it comes to the use of social media in crisis management. Considering A, B and C as the priori codes for sender and receiver, we first examine the 'author' and 'authorpage' column from the dataset. These two columns report the details of the sender of the tweet message. In majority of the cases, the information in the 'author' column was adequate to clearly identify the category of the sender either as an A, B or C. Alternatively, 'authorpage' (that shows the detailed information of the author) was examined to get more information about the sender. Once the identity of the sender was confirmed, it was counted as one of the existing categories of participants. In a case when the identity of a sender could not be confirmed or the 'authorpage' does not exist anymore, that tweet was discarded from further analysis. Although, the analysis on senders' category was started with three categories (agencies, business organizations and community members), it is imperative to note that one more category (known as government organizations) emerged as the result of data analysis. In contrary to Ahmed's (2011) previous framework that suggests the possibility of having only one-to-one communication such as (A-A, A-B or B-C), it was found that in case of Twitter, the messages are sent to the broader audience and not limited to only one specific receiver due to the 'follow' function of Twitter accounts whereby a single Twitter account may be followed by multiple other Twitter account holders. Considering Twitter as the communication channel, it is likely that one tweet would be received simultaneously by various types of receivers such as A, B and C. therefore, in order to cater for this situation a new category for receiver and labelled as 'ALL' was created for multiple receivers of a tweet message. The inclusion of this new category was deemed necessary when the existing codes were not fully matched with the category of the sender or receiver.

The analysis of tweets shows that individuals (referred as community (C)) are the key participant in Twitter communication during the five days after the 2014 Iquique earthquake. Of a sample dataset of 500 tweets included in the analysis, 356 (71.2%) tweets were sent by the individual community members. Other than individual community members, business organizations sent 65 (13.6%) tweets whereas disaster management agencies and government organizations initiated 58 (11.6%) and 18 (3.6%) tweets respectively. The summary of tweets initiated by various participants is presented in Figure 2 below:

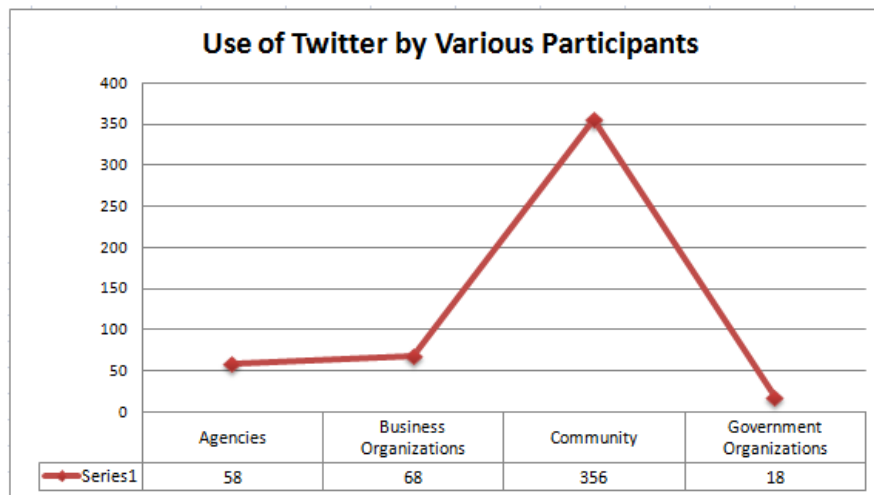


Figure 2: Use of Twitter by various participants

According to the data presented in Figure 2 above, the individual community members were the most active participants in crisis communication. Other than community members, the business organizations also used Twitter quite commonly to reach broader audiences after Iquique Earthquake. However, diminutive use of Twitter by disaster management agencies and government agencies indicates that this tool has not yet established as a strategic tool to disseminate official information in crises like Iquique earthquake. Though, individual community members commonly use Twitter during post-crisis phase, the information contained in those tweets cannot be verified by an official source and hence prone to incorrect and unreliable information (Murthy & Longwell, 2013). It is imperative to note that the trends reported above are true only for the dataset used in this study which may change by including larger dataset including tweets in languages other than the English.

### Communication Tasks

Further to the identification of various participants, this paper also examined the reasons (also referred as communication tasks) for the communication in post-crisis phase. The following table (Table 1) reports the communication tasks along with their codes, which were used to categorize various tweets.

Table 1: Communication tasks (Ahmed & Sinnappan, 2013)

Code	Communication Task	Code	Communication Task
AW	Alerts and Warnings	ID	Information Dissemination
SA	Collaboration and Situational Awareness	IW	Issue Warnings
CM	Communication	QF	Queries and Feedback
ED	Education	CW	Communication with the Rest of the World
MS	Moral / Emotional Support	CC	Coordination and Collaboration

As discussed earlier, the vast majority of tweets were sent by individual community members (71.2%) in post-crisis phase of Iquique Earthquake. We also found that an overwhelming majority of those tweets were used for Information Dissemination (ID). The analysis of the sample data reveals that out of 500 tweets, 154 (30.8%) tweets were used to disseminate general information related to Iquique Earthquake such as:

*“Chile lifts tsunami alerts after 8.2-magnitude quake” and  
“Terrifying animation shows how Chile tsunami took over the entire Pacific Ocean”*

Another common use of Twitter was to send Alerts and Warnings (AW) (139 tweets, that is, 27.8% of the dataset). There are number of instances when Twitter was used to send Alerts and Warnings related to Tsunami or after-shocks caused by Iquique Earthquake. Following are just few examples that highlight the use of Twitter to warn others about an upcoming disastrous situation.

*“Tsunami alert after 8.2 quake #strikes off Chile”*  
*“Powerful earthquake strikes off Chile, triggers tsunami”*  
*“Chile Earthquake 8.0 giant earthquake in Chile tsunami warning”*  
*“Chile won't stop shaking and more homes are getting destroyed not only that, more deaths plus more panic.  
 That tsunami warning is no joke.”*

Further to Information Dissemination (ID) and Alerts and Warning (AW), there are number of instances (58 tweets – 11.6%) when people used Twitter to update their situation or provide overall Situational Awareness (SA).

*“5 dead after powerful quake strikes off Chile's Coast - A powerful earthquake with a preliminary magnitude of 8.2”*

*“Fishing boats lie damaged by a small tsunami”*

*“WATCH: Animation of #tsunami after 4/1 #Chile #earthquake (shows amplitude of wave series) via NOAA's”*

Limited involvement of disaster management agencies and government organizations in Twitter communication resulted in only 3 (0.6%) occasions when Twitter was used for Collaboration and Collaboration (CC) after Iquique Earthquake. An overview of the use of Twitter during Iquique Earthquake is summarized in Figure 3 below.

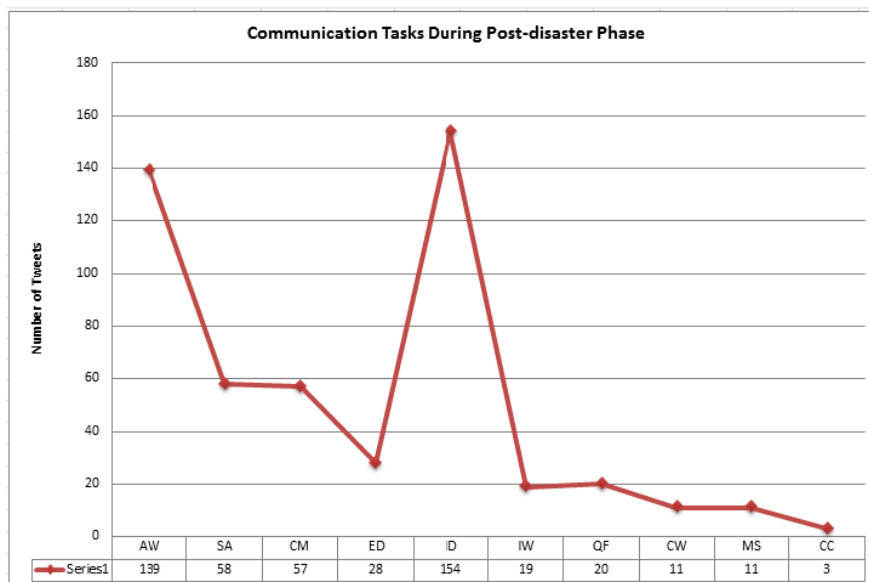


Figure 3: Communication tasks during post-disaster phase

The analysis of Twitter use by a particular category of participants reports some interesting trends. For all types of participants (disaster management agencies, community, business organizations and government organizations) involved in Twitter communication, ID remains the most important communication task except for business organizations which prefer to use Twitter to send specific warnings (AW) rather than just to disseminate general information relating to Iquique Earthquake. Moreover, it is imperative to note that there is nothing much coming from government organizations when it comes to AW which suggests that government organizations are not using Twitter as their strategic tool to reach people and to provide them specific information during Iquique Earthquake. Various disaster management agencies send significant number of warnings (AW) (25.85%) though their overall participation on Twitter was not immense. Since business organizations and individual community members sent most of the warnings (AW), there is a possibility of unreliability and the incorrectness of such warnings. (This paper does not aim to investigate the correctness of such alerts and warnings but acknowledges the relevant literature strongly suggests that this could be the case).

Another important communication tasks that is worth to discuss is Situational Awareness (SA). The individual community members are the leaders by sending (13% of their overall tweets) to inform others on up-to-date situation at the disaster zone. Lastly, there were very few tweets (3%), which came in from people who expressed their moral support and solidarity with the people affected by the Iquique Earthquake. In the sample data, there is no evidence that suggests that any disaster management agency, business organization or the government organization officially used Twitter to express their support and solidarity for the affected people. Figure 4 below presents the number of tweets and communication tasks based on each category of sender.

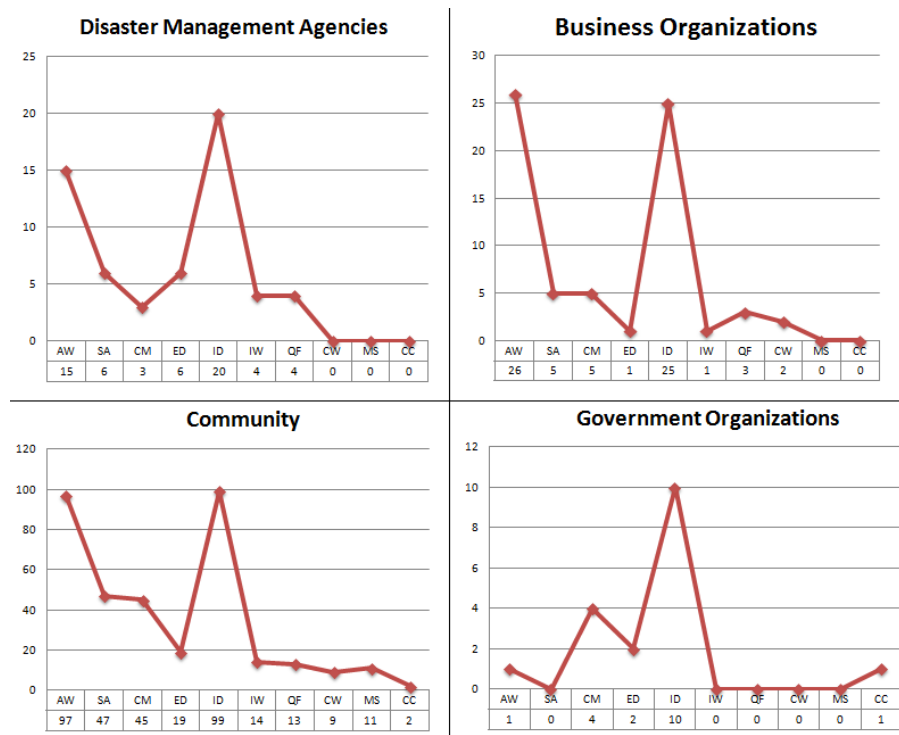


Figure 4: Number of tweets initiated by various categories of users

## DISCUSSION

The earlier sections of this paper underline the drawbacks in Ahmed (2013) initial framework and suggest that the framework was too generic and failed to address the questions on the unique characteristics of a particular social media application and the communications tasks which need to be performed in a particular phase of disaster management.

These questions will now be addressed systematically in the following discussion by examining the dataset through the theoretical lens of Ahmed and Sinnappan's (2010) framework.

### Participants in Disaster Communication

In this study, the analysis of the 500 tweets dataset clearly shows that individual community members were the most prolific tweeters. When the content of these tweets was further analysed, it showed how individuals worked with the 140 character limit imposed for a single tweet by composing concise messages or statements which are supplemented by images directly attached to the tweet or available through URL links. URLs embedded inside the tweet which takes the receiver to an array of other social media platforms such as Facebook, Pinterest and Instagram. This utilization of multimedia capacity of the content of tweets identified in this study supports the findings by Vieweg, et al (2010) that suggested social media as having an increased effectiveness on sharing of news in times of crisis. It should also be realized that individual members of disaster management agencies and government organizations might be contributing to the overall Twitter conversation about a crisis through their own individual accounts. This is not to suggest that they are using their individual accounts to tweet on behalf of the agency or government department they work for but rather they are acting in their own capacity by tweeting general messages which may have links to official online content provided on agency and government websites.

The relatively small number of disaster management agencies or government departments identified as the senders in this study was surprising to the authors (especially in the case when tweets were sent from organizations' official Twitter account and not from the personal accounts of the people who are working in such organizations). It would have been assumed that disaster management agencies or government departments were now at the forefront of using this technology yet this study indicates that assumption is not the case. There appears to be a distinct lack of involvement from disaster management agencies or government departments as sender in the crisis communication process. These agencies and departments, while having established Twitter and other social media accounts, have yet to embrace the use or fully realize the benefit of using the social media for information dissemination and use these tools as their strategic communication channels to reach more

people in disastrous situations. The content analysis used in this study reflects tweets utilizing embedded URL links to more familiar types of online information such as disaster management agencies or government department's websites. The authors suggest that a strategic approach by these participants is needed whereby a suite of social media and online tools are used for the effective dissemination of information, including alerts and status updates in the post-crisis phase of the disaster.

### **Level of Interaction among Participants**

The second component of the framework, which is to be discussed, is the level of interaction among participants in the communication process. The one-to-one level of interaction between Twitter participants in the 2014 Iquique Earthquake was generally limited. A one-to-many model of broadcasting was predominant in the mode of communication of this study and was the defining factor in the low level of interaction between participants. The authors believe this finding can be partly explained as contextual whereby the analysis of this study highlighted the ability for a single message to be tweeted by an individual and subsequently for that message to be disseminated quickly, almost exponentially, to many other individuals through the retweet function or where the original message or retweet was seen by other individuals through the 'follow' function / characteristic of Twitter. This characteristic of social media and for Twitter in particular for this study shows how information can be quickly disseminated. It is difficult to add that the retweet is contributing to the effectiveness in disseminating clear and correct information as this process relies on reliable and verifiable data disseminated in the original or subsequent tweets. Additionally, even though the majority of tweets analysed in this study were originated by an individual with no particular receiver in mind (that is to say the receiver has been classified as being 'all in the tweet coding), the ability to have a more targeted conversation is possible, and might have been occurred in the 2014 Iquique Earthquake Twitter conversation, where the original message was directed to an individual by name and/or use of hashtag.

### **Communication Tasks Perform During Disasters**

The final component of the framework under-discussion is the type of communication task performed by using Twitter in post – crisis phase of Iquique Earthquake. The communication task is closely associated with the purpose for tweeting. As previously shown in Table 1, there were ten different types of communication tasks possible for each tweet. The predominant communication task across all four categories of participants (disaster management agencies, business organizations, communities and government organizations) was information dissemination (ID). Alerts and warnings (AW) was the second most common form of communication task performed. These findings align with the categories of participants and the level of interaction among them. The purpose of the tweets was to quickly pass along information about the event and link into traditional online media sites such as newspapers and television stations where extended coverage could occur and include first-hand accounts, multiple images and videos and additional links to other sites, particularly to government agencies monitoring seismic data for up-to-date data on the event timeline, initial quake and subsequent aftershocks. This is perhaps another reason why the overwhelming majority of participants in the communication were individuals and the interaction between participants was low (almost a one-off) by an individual and then left up the retweet characteristic of Twitter to allow the original message to be disseminated quickly and efficiently. A rather surprising finding for the authors was the small number of tweets containing messages of sympathy, solidarity and well wishes (11/500, 2.2%).

The authors believe the greatest contribution of this paper is to the study of Twitter as a communication tool in crises such as the 2014 Iquique Earthquake by exploring the types of communication tasks undertaken by each category of Twitter user. The findings of this paper provide insight on why various types of participants send tweets in crisis and use media tools such as Twitter to facilitate crisis communication. As Resnyansky (2014) states, the multifunctional nature of social media complicates the situation whereby the social media "can and are used as communication media, broadcasting channels, and loci of social interaction within dynamic and diverse networked communities" (p. 61). Therefore a better understanding of 'ALL' participants to complement already comprehensive literature on the many forms of social media is worthwhile. As mentioned earlier, the emergence of 'ALL' as an additional category of receiver of tweets was reflected in the analysis of the dataset. A summary of the receiving of each communication task code highlighting the '*feeding in*' of communication tasks to 'ALL' is represented in Figure 5 below.



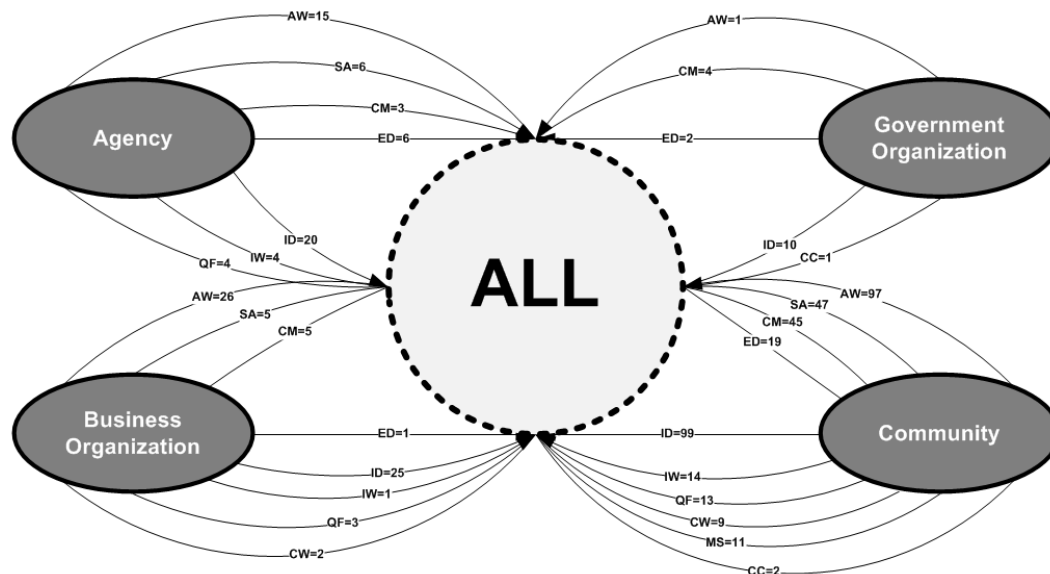


Figure 5: Summary of communication tasks by category of user

Finally, what was clear from the analysis of the 2014 Iquique Earthquake tweet dataset is that the geographical location of the individual tweeter was not directly linked to the location where the crisis event took place. This makes the inclusion of tweets which are sent in local Chilean languages marginal. The global reach of social media and Twitter in particular for this study, show that information in various forms such as text, symbols, pictures, audio or video, can be quickly and effectively disseminated across the globe to provide breaking news, ongoing status updates and alerts in a complementary way in which to build up a compelling story of an event. The use of social media continues to grow as users become familiar with the technologies and platforms. Rather than replacing established media, social media is providing an additional, quick and efficient method of communication, which facilitates traditional communication tasks.

## LIMITATIONS AND DIRECTIONS FOR FUTURE RESEARCH

A key limitation of this research is the exclusion of retweets in languages other than English tweets. Moreover, the dataset used in this study was one quarter of the actual number of English tweets captured. Therefore the analysis conducted in this study could be extended in breadth and depth and focus on achieving a greater understanding of the content of the message rather than the focus being on the participants as was the case in this study. It would be interesting to extend the dataset by including tweets in languages such as Huilliche, Kakauhua, Kunza and Mapudungun. Another area which could be explored in future research is the use of social network analysis (SNA) tools to uncover the key players in the communication process and why a particular individual's tweet was so enthusiastically retweeted by other individuals.

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