

**Responding to Natural Disasters with Social  
Media:  
A Case Study of the 2011 Earthquake and  
Tsunami in Japan**

**by**

**Jennifer Wilson**

B.A. (International Development, Hons.), University of Guelph, 2008

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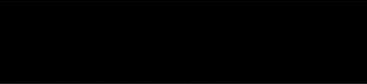
**Name:** Jennifer K. Wilson

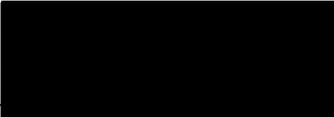
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**Supervisory Committee:**

**Chair:** John Harriss  
Professor

  
Nicole Jackson  
Senior Supervisor  
Associate Professor

  
Paul Warwick  
Supervisor  
Professor of International Studies and Political Science

**Date Approved:**

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## **Abstract**

The purpose of this paper is to investigate the use of social media during and after natural disasters, in order to determine if their use is advantageous for disaster response. A case study of the 2011 earthquake and tsunami in Japan is conducted, drawing on primary and secondary sources for content and document analysis. A social network approach, the In/Out/Seeker/Provider framework developed by Varda et al. (2009), is employed to analyze how different types of social networks used social media to seek and provide information and assistance. The results of the case study indicate that social media were used differently by four types of social networks, and while there were disadvantages to the use of social media, overall their use was advantageous for disaster response.

**Keywords:** Japan; social media; natural disasters; disaster response; tsunami; earthquake

## **Dedication**

This paper is dedicated to my family, who always believe in me, whether or not I believe in myself. To my father, for his continuous support of my various endeavours, wherever in the world they take me. To my mother, for her kind words and much needed care packages. To my sister, for our shared sense of humour and her reminders that I can always come home. To my relatives, for their words of encouragement and their solicited (and occasionally unsolicited) advice on all my life decisions. Finally, to the 2011-2012 MAIS cohort, a family created through our mutual struggles and triumphs, who kept me motivated and engaged throughout the Master program. Without the encouragement and support of my family, I would not be where I am today.

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## List of Acronyms

IOSP	In/Out/Seeker/Provider
NGO	Non-Government Organization
NPP	Nuclear Power Plant
TEPCO	Tokyo Electric Power Company
UN	United Nations
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
US	United States
USD	United States Dollars
WHO	World Health Organization

## List of Definitions

**Facebook:** A free social networking website that allows users to create profiles and share a variety of content with other users, including personal updates and photos (Facebook, 2012).

**Hashtag:** A voluntary index term that allows Twitter messages to be grouped easily by topic, comprised of a crosshatch character and a topic word (Gelernter & Mushengian, 2011).

**Hyperlink:** An electronic link that provides a direct link to a website or document (Merriam-Webster, 2012).

**Mixi:** A social media platform that incorporates status updates, blog posts, photo hosting and virtual communities. It is only available in Japanese, and new users can only join if invited by a current user (Redway, 2008).

**Open Source:** A technology that is free to access and edit, creating an opportunity for a collaborative effort where programmers improve the technology and share the changes with the online community (IBM, 2012).

**Trends:** A topic that is identified as being currently popular in messages posted on Twitter (Twitter, 2012a).

**Twitter:** A microblogging website where users can create a free account and post an unlimited number of messages (called tweets) that are a maximum of 140 characters (Clark, 2009). When a tweet is re-posted and shared with additional users, it is called a retweet (Twitter, 2012b).

**YouTube:** A video hosting website that allows users to create free accounts to watch and share originally-created videos online (YouTube, 2012).

# 1. Introduction

The rise of social media as a fast and effective means of information sharing has changed the way individuals and organizations communicate. Disaster communication is no exception; as individuals increasingly turn to the Internet for immediate information, disaster responders<sup>1</sup> are adapting to the fast paced communication that takes place online. Both during and after natural disasters<sup>2</sup>, social media have the potential to aid in the coordination of relief responses by connecting individuals to resources, and engaging a wider community beyond those directly affected. Social media have been praised as beneficial tools, and recent events, including Hurricane Katrina in 2005, the 2007 California wildfires, the 2010 Haiti earthquake and the 2011 earthquake and tsunami in Japan provide evidence to this (Clark, 2009; Hjorth & Kim, 2011; Nachison, 2005; Veil et al., 2011).

The term social media is defined by the Pew Research Center as “an umbrella term that is used to refer to a new era of Web-enabled applications that are built around user-generated or user-manipulated content, such as wikis, blogs, podcasts and social networking sites” (Pew Research Center, 2010b; n.p.). This definition is operationalized in this paper as “various digital tools and applications that facilitate interactive communication and content exchange among and between publics and organizations”

<sup>1</sup> The term “disaster responders” incorporates non-government organizations, government bodies and the individuals that work for them providing relief and support during and after natural disasters.

<sup>2</sup> The International Strategy for Disaster Reduction of the United Nations describes a disaster as “...a serious disruption of the functioning of society, posing a significant, widespread threat to human life, health, property, or the environment, whether caused by accident, nature or human activity, and whether developing suddenly or as a result of complex, long term processes” (Day et al., 2012; n.p.). This paper focuses on disasters that are caused by nature and occur suddenly, and the terms “natural disaster” or “disaster” will be used interchangeably.

(Jin et al., 2011; p. 2). This paper primarily focuses on the social networking sites Twitter, Facebook, YouTube, and Mixi.

At the beginning of 2012, there were over 800 million active Facebook users, and over 100 million active Twitter users (Daniells, 2012). Current trends indicate that the reach of social media will continue to grow as more individuals become active online. Social media tools are often free or low cost, increasing their accessibility to the wider population (Veil et al., 2011). Organizations and governments are acknowledging the capacity of social media to reach a wide audience with relatively little effort (Lindsay, 2011), and social media are already playing a role in the response to natural disasters. Disaster responders are sharing information and coordinating relief efforts both as the natural disaster is taking place, as well as during the aftermath, as the emergency response unfolds. Not only do disaster responders need to be aware of social media, but they also need to be prepared to take advantage of these new sources of information.

## **1.1. Argument**

This paper examines how social media played a role in disaster response during and after the 2011 earthquake and tsunami in Japan, and determines whether or not their use was advantageous for disaster response. This paper argues that during and after the earthquake and tsunami in Japan, social media were used differently by four types of social networks, characterized by those inside versus outside of the disaster-affected area, as well as by those who were seeking versus providing assistance. While the use of social media did produce some negative results, this paper argues that overall their use was advantageous for disaster response.

## **1.2. Case Selection**

On March 11, 2011, an earthquake occurred off the coast of Tohoku, Japan, and triggered a tsunami (United Nations Environment Programme [UNEP], 2011). While CNN, BBC, and Al Jazeera were three of the first international news media organizations to have live coverage of the disaster, initial reports spread faster through social media

(Shaw, 2011). Individuals were describing first hand accounts and sharing images and videos as the disaster unfolded. The wealth of information that spread through social media was publicly available, and constantly updated. Former foreign correspondent for the Associated Press, Dorian Benkoil, compared his experience of the 1995 Kobe earthquake in Japan to 2011: "Today, sitting in my living room in New York, I felt I had more information at my fingertips than I did then in the [Associated Press] bureau in Tokyo" (Benkoil, 2011; n.p.).

The case study of the 2011 earthquake, tsunami, and nuclear disaster<sup>3</sup> in Japan (referred to as "the earthquake and tsunami"<sup>4</sup>) is used to provide an analysis of the use of social media as tools for information sharing and collaboration during and after natural disasters. This case study has been chosen because the event was documented on a scale that had never before been witnessed, and was arguably "the first major environmental emergency in the age of social media and instant communication" (Strachan, 2011; n.p.). Digital journalism professor Sree Sreenivasan stated that the earthquake and tsunami was the most documented event in history (Sreenivasan, 2011). Information was shared online through a wide variety of popular social media platforms including Twitter, Facebook, YouTube and Mixi. As Strachan (2011) elaborates: "No country in the world is better prepared than Japan to deal with an earthquake in purely technological terms, and no country is better poised to show the rest of the world the inevitable aftermath in such exquisite technical visual detail" (n.p.).

<sup>3</sup> As the focus of this paper is on natural disasters, the damage done to the nuclear power plant (NPP) will be viewed as an effect of the earthquake and tsunami, not as a disaster in and of itself.

<sup>4</sup> This title was chosen for simplicity and consistency in the paper. The Government of Japan uses the title "the Great East Japan Earthquake," as does UNESCO, while other UN bodies use "earthquake and tsunami". The Japan Meteorological Agency refers to it as "2011 off the Pacific Coast of Tohoku Earthquake" and the media has used a wide variety of names including "The Great Quake," and "Japan's Triple Disaster".

According to New Media Trend Watch<sup>5</sup> statistics from February 2011, Japan had 94.2 million Internet users and 39.5 million social network users.<sup>6</sup> It is estimated that 83 percent of people in Japan used a mobile phone in 2011, greater than the estimate for American mobile phone users (75.7 percent) (New Media Trend Watch, 2012). In Japan, 65 percent of mobile phone users have a high-spec feature phone<sup>7</sup>, while six percent use mobile phones considered to be Smartphones (New Media Trend Watch, 2012). Although saturation of access to the Internet and use of social networks is not 100 percent, a majority of Japanese citizens utilize this technology to some degree. At the time of the earthquake and tsunami, Japan had an estimated ten million active users on Twitter, making the country one of the top markets for Twitter (Preston, 2011). Facebook had a smaller market share with two million active users, although it was popular among foreigners living in Japan, and was becoming more common with Japanese citizens (Johnston, 2012b). Mixi, the most popular social media site in Japan, boasted more than 20 million users (Preston, 2011). These statistics support the claims that Japan is one of the world's most technologically connected countries, and demonstrates why it was possible for information and images of the earthquake and tsunami to be digitally recorded and shared on such a large scale (Strachan, 2011).

### **1.3. Methodology**

The research for this paper is conducted through a qualitative case study. Drawing on primary and secondary sources, the earthquake and tsunami in Japan is used to explore how social media are used during and after disasters, and whether or not their use is advantageous for disaster response. While some academics have critiqued the difficulties of generalizability in using single case studies, Gerring (2007)

<sup>5</sup> New Media Trend Watch compiled statistics from eMarketer ([www.emarketer.com](http://www.emarketer.com)) and comScore ([www.comscore.com](http://www.comscore.com)).

<sup>6</sup> Japan's total population is 127,368,088 according to July 2011 estimates (The World Factbook, 2012).

<sup>7</sup> High-spec feature phones are mobile phones with advanced capabilities such as mobile-specific websites and satellite-based navigation systems (New Media Trend Watch, 2012).

notes that “[s]ometimes in-depth knowledge of an individual example is more helpful than fleeting knowledge about a larger number of examples. We gain better understanding of the whole by focusing on a key part” (p. 1). This paper utilizes the case study of Japan in order to allow for a more in-depth analysis than would be possible if multiple natural disasters were compared. Additionally, technology’s rapid rate of change complicates cross-comparison on the use of social media in disaster situations, unless both disasters take place at approximately the same time, or the research is meant to measure temporal changes. As the focus of this paper is not to examine temporal changes, a single case study is more appropriate and allows for a more detailed contextual analysis.

This paper uses the In/Out/Seeker/Provider (IOSP) framework developed by Varda et al. (2009) in their application of social network theory, which is further discussed in Chapter Two. The IOSP framework defines four different categories of social networks that exist in disaster situations. These categories are used in this paper to analyze how network members utilized social media, and what advantages and disadvantages came from that use. In the context of this paper, the use of social media is considered advantageous for disaster response when their use facilitates the disbursement of accurate information, two-way communication, and the mobilization of resources to effectively address actual need. The use of social media is considered disadvantageous when their use facilitates the unintentional sharing of misinformation, malicious intent to spread false information, unlawful financial gain, and the misallocation of resources. The content of social media messages, as well as the results of the messages, are used to evaluate whether or not the use was advantageous for disaster response.

In order to develop the case study of Japan, academic journals and news articles, which focus specifically on the 2011 earthquake and tsunami, are used. Each document is analyzed based on its content for references to, and examples of, the use of social media, and whether or not the use of social media is portrayed as advantageous for disaster response. Search terms used to locate the journals and articles include combinations of: Japan, earthquake, tsunami, 2011, social media, disaster response, Twitter, Facebook, YouTube, and Mixi.

Additionally, forms of social media including blogs, Facebook, Twitter, and YouTube are accessed in order to conduct content analysis. These primary sources provide examples of what types of messages were sent through social media; in some cases the information could be verified to determine whether or not it was accurate. The communication that took place through social media provides insight into what type of information was being shared (e.g. whether it was factual, a request for help, or an offer of assistance), who the information was directed at (e.g. whether it was information intended solely for disaster responders, the affected population, or a wider audience), and what conversation it was contributing to (e.g. if there are requests for verification of information, or coordination of efforts). This provides an understanding of how social media were used during and after the earthquake and tsunami, and highlights the ways in which social media can be advantageous or disadvantageous for disaster response.

In developing the context and growth of social media in disaster response, a document review is conducted and includes academic journals (which discuss disaster management, crisis communication and social media) and news articles from Japan and around the world (which discuss the use of social media during and after natural disasters). Search terms to locate the information include: disaster management, disaster response, social media, social networks, crisis communication, natural disasters, Twitter, Facebook, and YouTube. This combination of sources provides varied perspectives on the use of social media in disasters, and interpretations of their implications. Differing opinions exist within the literature, as some authors praise the use of social media, while others emphasize instances where social media fell short. This creates the context for this paper, and is used to explore recent uses of social media for disaster response.

## **1.4. Constraints**

This research faces two constraints, the first of which is a language barrier. For example, one popular social media site in Japan, Mixi, is only available in Japanese, making access to the text difficult. While it is possible to use translation software to assess the general context, exact translations are not always available. Some information has been professionally translated and made available by academics and

translators, which allows for access to primary data originally written in Japanese. Additionally, the social media site Twitter, which rose drastically in use during and immediately after the disaster, was used to send messages in English as well as Japanese.

The second constraint is the time lapse since the earthquake and tsunami took place. Not all forms of social media are archived online in such a way that the information is easily accessible one year after it was originally posted. However, information has been preserved by academics, news media and interested parties, and is accessible either in original form or in summary. In cases where the original text is not available, the types of information, motivations, and effects have often been recorded. As it is not feasible for this paper to analyze all uses of social media, examples are used based on availability and relevancy. Similarly, where groups and organizations are used as examples, the choices are made based on the greatest amount of information available, to allow for a more detailed analysis. The available information is sufficient for the objective of this paper, as the intent is not to conduct discourse analysis on the communication that took place through social media. More specifically, this paper seeks to better understand how social media were used during and after the earthquake and tsunami, and whether or not their use was advantageous for disaster response.

## **1.5. Outline**

This paper begins with a discussion in Chapter Two on social network theory, in order to establish the importance of social networks, and to develop the framework for this paper. While this paper does not utilize a social network analysis, a framework based on Varda et al.'s (2009) application of social network theory is employed. Once the framework has been established, the use of social media for disaster response is explored. A brief history of the changing use of social media during and after natural disasters is discussed, focusing on 2004 and beyond when popular social media platforms were created. This is followed by a literature review on the advantages and disadvantages of the use of social media in disaster response, providing an overview of pre-existing evaluations.

Chapter Three introduces the case study of the 2011 earthquake and tsunami in Japan. A basic timeline of the earthquake and tsunami is provided, and the ways in which social media came into play are explored based on Varda et al.'s (2009) four categories of social networks: In/Seekers, Out/Seekers, In/Providers, and Out/Providers. The ways in which social media were used during and after the earthquake and tsunami are analyzed based on the type of information being shared and what conversation it was contributing to. Following this, the disadvantageous aspects of social media use are highlighted. This section explores where social media fell short of being ideal tools for disaster communication.

In Chapter Four, the lessons learned from the use of social media surrounding the earthquake and tsunami are outlined. These are employed to discuss the ways Varda et al.'s (2009) four categories of social networks used social media, and suggests practices to diminish the disadvantages. Based on the findings of the Japan case study, future steps to further incorporate social media into disaster response are explored. In conclusion, Chapter Five summarizes the overall findings of this paper, and provides suggestions for future research into the use of social media during and after natural disasters.

## **2. Theoretical Framework and Academic Literature**

This chapter first outlines the concept of social networks, and discusses social network theory. By placing social network theory in the context of disaster response, the importance of social networks for this paper is established. The framework for this paper, based on Varda et al.'s (2009) application of social network theory, is then discussed. Following this, a discussion on the use of social media in disaster situations provides background information, and explores how the use of social media has changed over time. Finally, the advantages and disadvantages of the use of social media in disaster response are outlined through a literature review, providing an understanding of recent evaluations of the use of social media for disaster response.

### **2.1. Social Networks**

This paper explores the actions of social media users (both as individuals, and as formal and informal groups) who took part in online disaster response dialogue during and after the earthquake and tsunami. This paper argues that during and after the earthquake and tsunami in Japan, social media were used differently by four categories of social networks, which was advantageous for disaster response. The interactions of network members can be understood through social network theory, which focuses on relationships between people and communication structures, instead of the characteristics of an individual. Rogers (1986), as cited by the University of Twente (2010), describes a communication network as “interconnected individuals who are linked by patterned communication flows” (n.p.). He characterizes social network theory as the study of “interpersonal linkages created by the sharing of information in the interpersonal communication structure” (n.p.). As social network theory is flexible, it is possible to examine networks at the individual, community, and organizational level, and

incorporate various types of relationships and actors into the analysis (Varda et al., 2009).

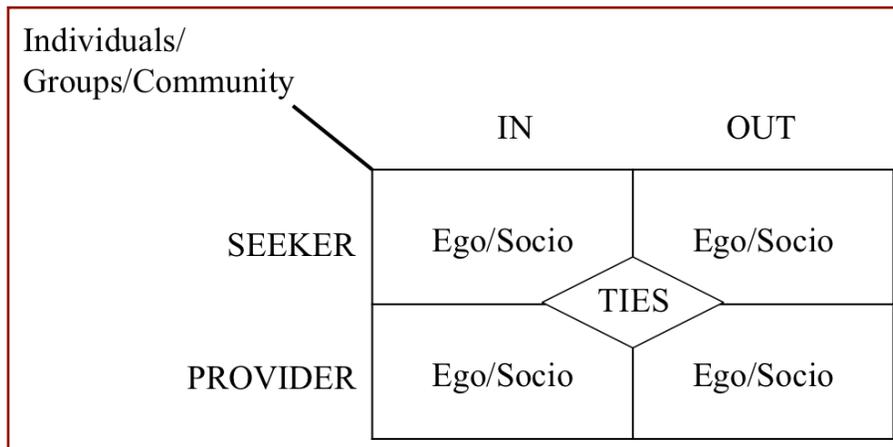
In the context of disaster response, social networks can play an integral role in response and recovery. Studies have found that when individuals have access to greater social support, they have higher levels of physical and mental health following a disaster (Haines et al., 2002). Additionally, interorganizational networks help facilitate information flows during disaster response, improving the coordination of relief efforts and allocation of resources (Kapucu, 2005). As the use of social media increases the social networks available to an individual, developing a stronger understanding of their use can lead to social networks and social media being more effectively incorporated into disaster response and community resilience projects. An improved understanding of the anatomy of social networks and social media in disaster situations has the potential to greatly impact access to, and use of, social networks in future disaster responses.

Authors have used social network theory to explore the role of personal networks following life events (Haines et al., 1996), networks at the organizational level in disaster response (Kapucu, 2005), and specific disasters such as Hurricane Katrina (Hurlbert et al., 2005; Robinson et al., 2006). Mukherjee and Soliman (2012) employ social network theory in their discussion on a social network approach to disaster planning. Focusing on mitigation and response, they develop a logic model to map the “relational resources from the social networks in community” (p. 21). They divide social networks into three categories: personal networks (friends and relatives), support networks (individuals, groups, and communities), and providers (government and non-government support). These social networks foster social cohesion and social capital, as communities with stronger networks are more resilient in disaster situations. This model requires extensive knowledge of the relationships between social media users, and is best employed when studying smaller networks.

Varda et al. (2009) developed the In/Out/Seeker/Provider (IOSP) framework as an adaptable framework to incorporate social network theory and disaster research in a variety of settings (Figure 1). They noted a deficiency in the application of social network theory in the disaster context, as most applications of the theory tend to focus on “small networks in very routine situations” (p. 12). Disaster situations, however, are dynamic,

and may incorporate a wide variety of networks that do not follow simplistic or consistent patterns. To address the need for a framework adequate for post-disaster recovery and similarly dynamic situations, the IOSP framework is meant to assist in identifying the categories in which disaster can be studied, as well as the impact of the networks, and to the networks. Unlike Mukherjee and Soliman's (2012) use of social network theory, the IOSP framework is more suitable for examining larger social networks, and does not require extensive knowledge of the relationships between individual social media users. In the IOSP framework, network members include individuals, groups, and communities, and can be analyzed from the egocentric individual level (Ego), or the sociocentric level (Socio). The sociocentric level can be broken down into dyadic, triadic, subgroup, and global levels. This flexibility allows the framework to be adapted based on the characteristics of the disaster situation being studied, the types of networks at play, and the information available (Varda et al., 2009).

**Figure 1. IOSP Framework (Varda et al., 2009 p. 14) Recreated.**



The IOSP framework is divided into four categories of social networks: those within the disaster-affected area seeking something such as information, resources or assistance from other network members (In/Seeker); those outside the disaster-affected area seeking something from other network members (Out/Seeker); those inside the disaster-affected area providing something to other network members (In/Provider); and those outside the disaster-affected area providing something to other network members (Out/Provider) (Table 1).

**Table 1. Explanation of the IOSP Framework**

Quadrant	Type	Description <sup>8</sup>	Example
Q1	In/Seeker	Network members who are in the disaster area, seeking something from others in the network	Individuals in the disaster-affected area asking to be rescued
Q2	Out/Seeker	Network members who are out of the disaster area, seeking something from the network	Individuals outside of the disaster-affected area seeking information about loved ones
Q3	In/Provider	Network members who are in the disaster area, providing something to other network members	Non-government organizations and government bodies in the disaster-affected area offering relief supplies
Q4	Out/Provider	Network members who are out of the disaster area, providing something to other network members	Online groups outside the disaster-affected area creating platforms to help share information

Varda et al.'s IOSP framework is utilized in this paper to establish divisions in the types of social networks that were used during and after the earthquake and tsunami in Japan. The networks are viewed from a sociocentric subgroup level, which Varda et al. (2009) operationalize as “[evaluating] the connectedness of the various subgroups based on components and cliques” (p. 19). The four categories defined by Varda et al. (2009) are used to identify the types of communication taking place, analyze how network members from each of those groups utilized social media, and identify what advantages and disadvantages came from that use. The members of the social networks include: individuals and members of the general population, including those who were directly affected by the earthquake and tsunami and those who were not; online groups, including those that developed or adapted online platforms for collaborating and vetting information; non-governmental organizations (NGOs), including the Red Cross and Save the Children; and governmental bodies, including the Japan Meteorological Agency and the United States (US) Embassy. The IOSP framework

<sup>8</sup> Each “Description” in Table 1 was taken from Varda et al., 2009; p. 14-15.

allows for the analysis of a variety of actors participating in different types of social networks during a dynamic situation such as a natural disaster. The adaptability of this framework makes it suitable for examining the use of social media in natural disasters.

## **2.2. Social Media in Natural Disasters**

The social networks examined in this paper use social media to collect and share information. This section introduces the use of social media during and after natural disasters, and establishes a brief history of the changes that have taken place in their use. First employed by disaster responders as a one-way means of communication to disseminate information, social media now facilitate two-way information sharing between networks and network members. The ability to quickly share information in disaster settings is advantageous for disaster response.

During and after a natural disaster, communication is vital and time is limited. However, in a disaster environment, communication can be difficult as some information is not available, or may not be getting to the individuals and organizations that need it (Day et al., 2012). Traditional lines of communication often break down or operate on too slow of a timeline to be effective in a crisis situation, making it necessary to create alternative means of communication. For example, warning systems that send notifications through television, e-mail, and text messaging, are useful for providing information to the public quickly and effectively (Ferguson, 2011).

Social media began playing a role in disaster response as their use became increasingly widespread on an international scale. While access to the Internet is far from universal, an international study by the Pew Research Center found that when individuals have the opportunity to go online, the majority take part in social networks (Pew Research Center, 2010a). When disaster responders became aware of the increasing use of social media by the general public, they began to use social media themselves. Originally, disaster responders used these online platforms in a purely one-directional manner, to present information from the organization to their audience. This one-way dissemination of information is now becoming obsolete; instead, there is a growing movement towards a dynamic and systematic flow of information. This includes

receiving requests for assistance, sourcing information from social media users for situational awareness, and responding to questions (Lindsay, 2011; The Economist, 2011).

Jay Rosen notes that the movement towards an interactive online community began in 1999 when there was a “shift of the tools of production to the people formerly known as the audience” (The Economist, 2011; n.p.). This shift came with the wide availability of blogging tools, giving a means of communication to regular citizens. Next came the rise of “horizontal media,” which provides the sharing of information without going through traditional media sources. Instead, information and hyperlinks are quickly shared among large numbers of individuals through social media (The Economist, 2011). Popular social media evolved as new platforms were developed in quick succession, including Facebook (2004), YouTube (2005), and Twitter (2006),<sup>9</sup> and the number of registered users climbed into the hundreds of millions.

New media experts have noted that Hurricane Katrina in 2005 was the first demonstration of how disaster response was changing now that individuals possessed “an unprecedented capacity to access, share, create and apply information” (Nachison, 2005; n.p.). The use of social media facilitated collaborative online efforts to locate missing people and emergency housing, and coordinate volunteers (Nelson et al., 2010 as cited in Goldfine, 2011). Hurricane Katrina was one of the first natural disasters that “marked the coming of age of participatory media” (Haddow & Haddow, 2009; p. 41). It has been stated that Hurricane Katrina established social media as the go-to for information during times of crisis (PR Newswire, 2011). This disaster took place as social media were beginning to gain popularity with the general public, and were well known and used enough to make the transmission of information through social media platforms feasible and effective.

<sup>9</sup> This is by no means an inclusive list, but these are among the most popular social media sites worldwide (Norman, 2012).

In addition to traditional disaster responders, groups that form online to provide support are also responding to the needs of individuals affected by a disaster. Some online groups have evolved sporadically, reacting to specific events, such as tornados, floods, and wildfires (Viel et al., 2011). Other social media communities are long-standing groups who continuously monitor events around the world, and are on stand-by to lend their voices and expertise as disasters unfold. Social media have allowed users to feel increasingly connected, and able to collaborate despite geographic, temporal, and linguistic boundaries (Hjorth & Kim, 2011). Participants have been able to develop their own norms to increase accuracy, such as insisting on verification from anonymous sources, seeking clarification, and searching for confirmation from multiple sources (Kiss, 2011; Winerman, 2009). It is no longer necessary for an individual to be on ground zero of a disaster to be well informed on the immediate situation.

The creators of many social media platforms were not aware that they were developing such powerful tools. For example, Twitter was originally designed as a way to send text messages within a group, but it has evolved far beyond an exchange of mundane messages (Walker, 2011). One of the first uses of hashtags on Twitter was for tracking the wildfires in southern California in 2007. Messages which included “#sandiegofire” were tracked both during and after the fire, along with other relevant terms, creating a record of the event (Clark, 2009). Residents were taking photos of the fire and reporting its location before journalists were able to get to the scene (Veil et al., 2011) and many people found the mainstream news coverage of the overall situation of the fire to be insufficient, given the importance of knowing the situation on the ground (Winerman, 2009). Now, it is common practice for a wide variety of events, including natural disasters, to have multiple hashtags assigned as users voluntarily tag their messages to become part of a larger conversation.

### **2.3. Advantages**

As this paper argues that the use of social media is advantageous, it is necessary to establish what aspects of social media are useful for disaster response, and what outcomes from the use of social media are advantageous. Discussions on the advantages and disadvantages of social media in disaster response have begun to

evolve in academic debate, as well as in the development of best practices and guidelines by practitioners. This section provides support for the argument of this paper, and offers an overview of the types of social media uses that are identified in the case study of the Japanese earthquake and tsunami.

The advantages of social media for information sharing and coordination of relief efforts have been documented by a variety of authors in various disaster environments. The widespread use of social media, and their ease of use, is noted by Daniells (2012) and Gelernter and Mushegian (2011). Most social media sites only require that a user has an e-mail account in order to sign up, and provide simple online orientations to sharing and searching for information. Gao et al. (2011) discusses the benefits of social media's fast and effective use for information sharing from a variety of sources. It is possible for experts to interact with the general public, and for messages to be sent instantly from computers, cell phones, and other electronic devices. Social media establish a two-way channel of communication between affected groups and disaster responders (Lindsay, 2011), allowing the previously one-way dissemination of information by disaster responders to become a dynamic conversation.

There are opportunities with social media for international and local individuals and groups to collaborate (Hjorth & Kim, 2011; Veil et al., 2011), making it possible for individuals around the world to take part in online relief efforts. Through the development of online social norms, social media users have developed the tendency for self-correction of inaccurate information (Winerman, 2009), increasing the likelihood of accurate information being distributed. While phone lines may be damaged or overwhelmed during disaster situations, social media are often resilient, and aid in maintaining lines of communication (Gao et al., 2011). As previously noted through the California wildfires, social media also facilitates the localization of coverage of an event (Clark, 2009). All of these benefits make the effective use of social media advantageous for disaster response.

Best practice lists, providing guidelines for how social media should be used by disaster responders, have been developed in order to maximize the advantages that social media can provide. Developed by disaster responders, these lists have been critiqued, merged, and recreated (Goldfine, 2011; Lindsay, 2011; Seeger, 2006; Veil et

al., 2011; White & Plotnick, 2010). Online groups do not have standard best practice lists, but often have developed some user guidelines, and generally have a leadership team that takes overall responsibility for the efforts.<sup>10</sup> Members of the general public have the least amount of guidelines, and the least amount of responsibility for their online actions. It is primarily social norms and peer pressure that mould their practices, although social media platforms have certain types of behaviour that are not tolerated, such as abusive language. However, it is generally left to social media users to resolve their own concerns over the content of messages. Social norms and the dynamics of online communities can prove to be effective in promoting “acceptable” behaviour and deterring undesirable conduct (Jerbi, 2011; Meier, 2011; Millar & Choi, 2009).

## **2.4. Disadvantages**

It is important to highlight that with the benefits of social media in disaster response come disadvantages as well. The possibility of negative outcomes from the use of social media is one of the motivations for developing best practices and guidelines. The best practices are an attempt to mitigate these disadvantages, and amplify the advantages.

Clark (2009) notes that mass amounts of information can be difficult to sort through, which is particularly detrimental when some social media users require more immediate attention. It can also be challenging to discern urgency in messages (Gelernter & Mushegian, 2011), particularly when context is not provided, and the tone of the message cannot be determined. Chavez (2011) notes similar issues, stating that social media have been criticized for the tendency to transmit short messages, which may leave out important information, and create difficulty in deciphering opinion from fact. In addition, false and inaccurate information spreads just as quickly as accurate

<sup>10</sup> For example, open source software is available to anyone, but it is necessary for someone to adapt the software, implement it, and monitor it.

information, which can cause unnecessary panic, or the misallocation of resources (Clark, 2009; Gao et al., 2011; Gelernter & Mushegian, 2011).

Coordination between organizations responding to social media remains largely unaddressed (Gao et al., 2011), meaning that someone who requests help may have several people or organizations respond and overlap relief efforts. As requests for assistance are passed along through various online networks, it becomes increasingly difficult to determine which ones have been addressed. There are also privacy and safety issues, which can arise from the public sharing of information, and collection of data online (Gao et al., 2011; Merchant et al., 2011).

Access to social media is not universal (Merchant et al., 2011), leaving some individuals and segments of the population unable to obtain the information being shared online. This includes the elderly, who generally do not have the knowledge or experience using social media and other technology, and those who cannot afford the computers or cell phones required to create and use the free social media accounts. There are also geographic barriers, since social media tools are not available or accessible in some areas. In places where there is no mobile phone coverage, Internet access, or electricity to power or recharge devices, the use of social media becomes a moot point (Paul, 2012).

As demonstrated in this section, social media has the potential to be disadvantageous for disaster response. Issues with misinformation, malicious intent and a lack of accessibility are all serious drawbacks to social media. However, this does not negate the advantages that social media provides. As disadvantages are identified and addressed, they can be mitigated, and their potentially negative impacts can be reduced. Social media, as with any tools, are not inherently advantageous or disadvantageous. It is the way they are used, and the intentions of the individuals who use them, that in turn lead to their use being advantageous or not. Therefore, exploring which social networks used social media, and how they used it, is important for determining whether or not the use of social media was advantageous for disaster response during and after the Japanese earthquake and tsunami.

### **3. The 2011 Japanese Earthquake and Tsunami**

As previously noted, the case study of the Japanese earthquake and tsunami was selected because the event was documented through social media on a scale that had not previously taken place (Strachan, 2011). Japan is one of the world's most technologically connected countries, and current trends indicate that social media will become increasingly used around the world. Therefore, the case study of the earthquake and tsunami can provide insight on the use of social media for future natural disasters. After establishing the context of the case study, this chapter employs Varda et al.'s (2009) IOSP framework to explore how four different networks utilized social media during and after the earthquake and tsunami. Following this, the ways in which social media were found to be disadvantageous are examined.

#### **3.1. Context**

Japan has the world's densest seismometer network, the biggest tsunami barriers and the most extensive earthquake early-warning system. Its population is drilled more rigorously than any other on what to do in case of earthquakes and tsunamis (Cryanoski, 2011; p. 556).

On March 11, 2011, at 2:46pm local time, a 9.0 magnitude earthquake occurred off the coast of Tohoku, in Eastern Japan. The tremors lasted for approximately six minutes and triggered a tsunami that reached up to an estimated 30 meters in height, washing up to five kilometres inland (Mimura et al., 2011; UNEP, 2011). The results were devastating, with a high number of fatalities, environmental destruction and infrastructure damage, including serious damage to the Fukushima Nuclear Power Plant (NPP) (Mimura et al., 2011). Buildings and transportation systems were demolished, electrical blackouts occurred, and telephone networks were congested to the point of not functioning (Huffington Post, 2011). The World Bank (2011) estimates the economic cost of the disaster to be between \$122 and \$235 billion USD. One year after the disaster,

Japan's National Police Agency reported the death toll at 15,854, with an additional 3,271 individuals still unaccounted for (Ryall & Demetriou, 2012). An estimated 343,935 people were evacuated, and over 6,000 individuals were injured (Johnston, 2012a).

Almost as soon as the first tremors were felt, messages were sent through social media as people in Japan experienced the earthquake. One of the first messages noted by Doan et al. (2011) was posted on Twitter one minute and 25 seconds after the earthquake hit at the epicentre. Before the ground had stopped shaking, videos of the initial effects of the earthquake were already being uploaded online (Blackburn, 2011). Official and unofficial warnings were broadcast through social media, including evacuation notices for the impending tsunami (Acar & Muraki, 2011). Reading messages sent through Twitter, it is possible to map out minute-by-minute how the event unfolded. Social media users reported seeing the water receding, and shared their intentions to evacuate and seek higher ground (Acar & Muraki, 2011). When the tsunami swept in, users reported flooding, destruction, and loss of life. Messages pleading for rescue, seeking supplies, and mourning losses were met with messages of concern for loved ones, offers of assistance, and condolences (Acar & Muraki, 2011; Doan et al., 2011).

### **3.2. Social Media Responds**

The phone lines were overloaded as people tried to contact their family and friends, as well as reach out for information and assistance. This drastically reduced the ability of landlines and cell phones to facilitate emergency communication. As a result, social media became all the more important (Inomata, 2011). Following the initial onset of the earthquake and tsunami, social media became tools for response and recovery. While phone services were down, The National e-Infrastructure for Social Simulation tracked that the number of messages on Twitter from Tokyo alone were surpassing 1,200 per minute, less than an hour after the tsunami struck (Taylor, 2011). As summed up by Johnson (2012b),

Twitter, Facebook, YouTube and other social media provided a window for survivors to alert and keep the outside world informed about what was happening in the disaster areas, search for their loved ones, and provide updates and analysis of statements released by the government and

Tokyo Electric Power Co. on the unfolding Fukushima No. 1 nuclear plant disaster<sup>11</sup> (n.p.).

Messages were sent out on Twitter sharing information “about everything from emergency phone lines for non-Japanese speakers to tsunami alerts, altered train schedules and lists of shelters for those left homeless” (Huffington Post, 2011; n.p.). As news and images spread online, hashtags including “#prayforjapan”, “#earthquake” and “#tsunami” began trending on Twitter (Blackburn, 2011). By searching these hashtags, Twitter users seeking and providing information were able to follow along with updates and messages about the earthquake and tsunami.

As detailed in the previous chapter, Varda et al.’s (2009) IOSP framework will be employed to explore the ways in which social media were used by various networks to share different types of information. In Table 2 below, the four IOSP categories are relisted and related to the Japan case study, along with examples of the types of network members associated with each category, and the type of information shared through social media. The sections that follow will discuss how each type of network used social media depending on their needs and goals, and provide examples for each.

**Table 2. Examples for the IOSP Framework**

Type	Examples
In/Seeker	Individuals seeking immediate assistance for themselves and others; individuals seeking information on the environment; NGOs in the disaster affected area asking for supplies; government officials in the disaster affected area asking for support
Out/Seeker	Individuals outside of Japan seeking information about loved ones; organizations seeking information to provide appropriate assistance; online groups asking for information to update crisis maps
In/Provider	NGOs in the affected area offering food and shelter; disaster responders providing support to other organizations and individuals
Out/Provider	Online groups creating platforms to help friends and family find information on loved ones; individuals sharing warnings

<sup>11</sup> Note that “Fukushima No. 1 nuclear power plant” is also known as “Fukushima Nuclear Power Plant”, as it is referred to earlier in this paper.

### **3.2.1. In/Seekers**

As described by Varda et al. (2009), In/Seekers incorporate those who are inside the disaster-affected area, and are seeking assistance or information. Since it is not possible to verify the location from which each message was sent out, the content of the message has been used to determine whether or not it was sent from a network member within the disaster-affected area. The main types of In/Seekers during and after the earthquake and tsunami were individuals seeking immediate assistance for themselves and others, individuals seeking information on the environment, requests for supplies, and government officials asking for support.

While the domestic social media site Mixi was already popular in Japan, Twitter was becoming widely used (Johnston, 2012b). Acar and Muraki (2011) conducted a qualitative study of messages sent following the earthquake by Twitter users in Japan from directly affected areas and indirectly affected areas. From within the disaster-affected area, the messages analyzed by Acar and Muraki (2011) that can be categorized as In/Seekers were primarily help requests<sup>12</sup>. Social media users also reported on the environment and what they were witnessing.<sup>13</sup> Acar uncovered a series of messages sent out by an individual trapped on the roof of a hospital. It was possible

<sup>12</sup> Examples of help requests are “We’re on the 7<sup>th</sup> floor of Inawashiro Hospital, but because of the risen sea level, we’re stuck. Help us!”; “Thirty people are stuck at Ozaki shrine. It seems the roads are shut down. Anybody, please call police and fire department. Anyways, I’m OK.” (Acar & Muraki, 2011, p. 396-398)

<sup>13</sup> Examples of environment messages are: “An aftershock is still continuing. Be calm”; “A building exploded. It’s south of Kesenuma-Minami station”; “In front of the Fish Market is burning” (Acar & Muraki, 2011, p. 396-398)

to follow along through the individual's pleas for help, fears of death and eventual rescue (Garner, 2011).<sup>14</sup>

Twitter and Facebook were favoured tools for foreigners living in Japan who wanted to assure their family and friends that they were safe (Blackburn, 2011). However, for foreigners in Japan who did not speak Japanese, accessing information was more difficult than sending it. Following the disaster, there were rolling blackouts and changes to the availability of transportation – important information that was not widely translated in traditional news sources (Paul, 2012). News that was being reported in other languages primarily came from non-Japanese news stations, and websites that tended to take a national focus. Local information that was pertinent to foreigners was omitted because it was not relevant to the general audience (Paul, 2012). Foreigners who did not speak Japanese turned to social media in order to ask their contacts for information, and find news updates relevant to their specific location. On Twitter, it was possible to search hashtags for specific cities and regions to request and gather available information in both Japanese and English.

Mayor Katsunobu Sakurai of Minamisoma, a city inside the no-go zone<sup>15</sup> around the Fukushima NPP, used YouTube to request assistance (Jones, 2011). He posted a video on YouTube two weeks after the disaster, venting his anger at the lack of response from the central government, and pleading for international support. His actions went against the standard for civil servants in Japan to conform and show a united front (Jones, 2011). In response, supplies were shipped from other parts of the country, and from overseas. The video garnered over 200,000 views, and resulted in apologetic phone calls from the Chief Cabinet Secretary of Japan, and from the Tokyo

<sup>14</sup> Messages sent from “@hinoyoujinn’s” account included: “I’m on the roof of Sato Hospital near from Kesenuma-Minami station. #kesenuma”; “I may die. #kesenuma”; “If the flame comes. there’s no way to escape. #kesenuma” and “I barely survived. I was rescued by SFD (Japanese Army)...” (Garner, 2011; n.p.). The hashtag “#kesenuma” indicated his location.

<sup>15</sup> On March 12, 2011, a no-go zone was established within a 10km radius around the Fukushima NPP due to radiation fears. Those within the zone were evacuated and entrance into the zone was limited. On March 14, the no-go zone was extended to 20km, and eventually to 30km (Jones, 2011).

Electric Power Company (TEPCO) (Johnston, 2012b). The large audience that Mayor Sakurai's video reached through YouTube prompted an effective response, and the attention of his superiors in the government. Mayor Futoshi Toba of Rikuzentakata followed suit, and also posted a video on YouTube requesting help from the international community for the residents of his city (YouTube, 2011).

Officials from Kyoritsu Hospital, located 27 miles from the Fukushima NPP, turned to Twitter after local authorities failed to help evacuate patients. When local support could not be garnered, the officials sent two messages through Twitter to US Ambassador John Roos, asking if the US military could help transfer patients.<sup>16</sup> The messages reached Roos' mobile phone at 4pm local time – he notified the US Embassy's defence attaché, who then put the message through the US military chain of command. An hour later, Roos received word that Japan's Ground Self-Defense Forces would evacuate the patients (Sternberg, 2011). As this example demonstrates, one of the benefits of social media is that they make information publicly available, and can play an important role not only in raising awareness and support, but can also put pressure on national and international authorities to take action.

Overall, In/Seekers requested rescue for themselves and for others, sought information on the post-disaster situation, and asked for relief supplies. In/Seekers' use of social media was advantageous, as it allowed vital requests to be shared when traditional means of communication were disrupted. The ability of messages on social media to reach a wide audience and be easily shared with others helped amplify requests for assistance, and bring them to the attention of In/Providers and Out/Providers.

<sup>16</sup> The two Twitter messages were: "Kameda hospital in Chiba needs to transfer 80 patients from Kyoritsu hospital in Iwaki city just outside of 30km(sic) range" and "Some of them are seriously ill and they need air transport If US military can help pls contact (name withheld) at Kameda" (Sternberg, 2011; n.p.).

### **3.2.2. Out/Seekers**

Out/Seekers incorporate those outside the disaster-affected area who are seeking assistance or information (Varda et al., 2009). The main types of Out/Seekers during and after the earthquake and tsunami were individuals seeking information about family and friends located in the disaster-affected area, and NGOs requesting funding for their response efforts. Being located outside of the disaster-affected area meant that most Out/Seekers had greater access to social media, and more access to information in general, than In/Seekers.

Family and friends living outside of Japan were concerned for the wellbeing of their loved ones. Since they were unable to make contact through phone lines, individuals went online to send messages through Twitter, Facebook, and other social media platforms, seeking confirmation that family and friends were safe (Blackburn, 2011). Those living in Japan were able to send out a message through social media to indicate their status. Instead of spending time trying to access a phone connection, or relay information through the Red Cross and other organizations that help reunite families, it was possible to quickly disseminate information on an individual's condition. The Google Person Finder (which is discussed further in the Out/Providers section) offered another platform to search for information. As a user-generated database, it was possible to create an entry for a missing individual, and request that others help verify their safety (Google, 2012).

In some cases, social media proved to be more helpful to Out/Seekers than In/Seekers, depending on who had access. One example of this was a 15-year old student in Japan who took refuge under her desk at school during the earthquake. Through Facebook, she was able to send instant messages to her cousin in Liverpool, England: "She couldn't contact her parents a few miles away – the phones were down and the trains had stopped running – but we knew she was OK on the other side of the world" (Wallop, 2011; n.p.). People with access to social media outside of the affected area had access to more information than those without social media inside the affected area.

NGOs were quick to utilize social media to raise funds for their relief efforts. For example, the Red Cross began to collect \$10 donations through a text-to-donate system

that had previously been successful in raising funds following the 2010 Haiti earthquake (Blackburn, 2011). Similarly, Save the Children, World Vision, Mercy Corps, and The Salvation Army all used text-to-donate giving programs. By sending a text message with a specific code to a specific number, mobile phone users were charged an additional \$5 or \$10 on their monthly statement, with the funds donated to the NGO of their choice (Heussner, 2011).

Additionally, popular social games played online through social media platforms such as Facebook were used to raise funds. Zynga Inc., the largest developer of social games, created limited edition virtual items that the 250 million players who use their games could purchase (Save the Children, 2011). The funds went to Save the Children's Japan Earthquake Tsunami Children Emergency Fund, and the American Red Cross. By March 28, 2011, Zynga's efforts had raised over \$3 million (Zynga, 2011).

Out/Seekers found social media to be advantageous for searching for information about family and friends, as well as raising funds for relief efforts. Unlike In/Seekers, Out/Seekers were safely located outside of the disaster area, and were generally able to access a greater amount of information. Social media helped engage individuals around the world in disaster response through fundraising and bridging the geographic distance between Out/Seekers and In/Seekers.

### **3.2.3. *In/Providers***

Varda et al. (2009) characterize In/Providers as those who are inside the disaster-affected area who are providing assistance or information. In the context of this case study, In/Providers include individuals sharing information, as well as both NGOs and governmental bodies that stepped in after the earthquake and tsunami to help re-establish lines of support. This includes the social media communications of Japanese government bodies and non-Japanese government bodies, as well NGOs that played a role in the response to the earthquake and tsunami.

Japan has one of the world's most advanced early warning systems, as the government invested heavily in the technology following the devastating 1995 Kobe earthquake. The 2011 earthquake struck off the east coast at 2:46:45pm local time – by 2:46:48pm a warning was automatically issued. The warning was distributed to factories,

schools, TV networks, radio stations, and mobile phones (Birmingham, 2011). The first information about the earthquake and tsunami provided to those in Japan were warnings issued by the government. The earthquake warning gave people from seconds to one or two minutes until the worst of the tremors hit. The tsunami warning was sent less than nine minutes after the earthquake struck, and provided the areas that would be hardest hit with approximately 15 minutes of warning (Birmingham, 2011). The tsunami warning was broadcasted on seven TV and radio stations, with limited multi-lingual broadcasts available through a second sound channel<sup>17</sup> on TV and one radio channel (AM2) in English, Chinese, Korean and Portuguese (Sakai, 2012).

In response to the difficulties faced by non-Japanese speakers attempting to access local information, NGOs sent out messages through Twitter with information such as translated lists of shelter locations (Wallop, 2011). The US State Department responded through social media, using Twitter to inform their citizens in Japan of emergency numbers to request assistance (Wallop, 2011) as well as shelter locations and websites to gain access to information in English (US Embassy Tokyo, 2011a; 2011b). The Japanese Prime Minister's Office also started using an English-language Twitter account on March 16, 2011, in order to provide updates on evacuations, press conferences, and the country's overall welfare. In the first two hours after the account was created, there were already 7,000 Twitter users following it.<sup>18</sup>

Additionally, individuals in the directly affected area shared information amongst themselves during and after the earthquake and tsunami. This included warnings and

<sup>17</sup> Second sound channels, also known as secondary audio programs, allow television stations to broadcast two sound channels for one show. The technology is standard on most televisions made within the past 15 years (ABC News, 2007).

<sup>18</sup> The messages sent through the account (“@JPN\_PMO”) were translated tweets from the Japanese disaster information account (“@Kantei\_Saigi”), which had been created on March 13 by the Prime Minister's Office (Peters, 2011).

messages about their personal environments, which provided situational awareness<sup>19</sup> (Acar & Muraki, 2011). One Twitter user aggregated messages on the major railway lines through an online file-sharing service, creating one online location for multiple status updates on the railway lines. The website was viewed hundreds of thousands of times (Ying, 2011). Those with access to information were able to share it with a wide audience, and provide important situational awareness and updates on the environment that others may not have had access to otherwise.

In/Providers primarily used social media to send out warnings, provide information on where assistance could be accessed, and to share reports about the post-disaster situation. Social media was advantageous in quickly providing updates to a wide population through multiple platforms. The information organized and shared by In/Providers provided assistance to both In/Seekers and Out/Seekers, filling information gaps created in the aftermath of the disaster.

#### **3.2.4. *Out/Providers***

As outlined by Varda et al. (2009), Out/Providers incorporate those outside the disaster-affected area who are providing assistance or information. For this paper, the Out/Provider category includes online groups that developed or adapted online platforms for collecting and vetting information, as well as individuals from outside of the disaster affected area who shared warnings and concerns. Individuals who were not connected to anyone in Japan, but had heard about the earthquake and tsunami, were also sending messages of condolence and encouragement.

Less than two hours after the earthquake took place, Japanese volunteers at Tufts University created an interactive map called “Sinsai” to identify locations where individuals had been trapped, hazardous areas, and sources of food and clean water

<sup>19</sup> Examples of warnings and messages about the environment are: “An alarm of BIG tsunami: Coast of Miyagi prefecture. Escape to any high place”; “I hear the tsunami alarm. I’m gonna escape”; “The sea level is falling rapidly. I think we’re gonna have tsunami soon” (Acar & Muraki, 2011, p. 401-402).

(Naone, 2011). Sinsai was built on a free and open source platform that had been developed by the technology focused non-profit organization Ushahidi. It was originally developed to track acts of violence and efforts for peace following the 2007 Kenyan elections, and has since been adapted to a variety of situations. Information submitted through mobile phones, e-mail and Twitter are streamlined and charted on a publicly available online interactive map (Paul, 2012). One month after the earthquake and tsunami, there were over 430,000 unique visitors, a total of 1,213,258 page views, and 9,405 reports published to the map (Seki, 2011).

Within two and a half hours of the earthquake taking place, Google had launched its Person Finder web application. This open source software was designed to assist individuals in finding the status of family and friends affected by a disaster through posting information and searching pre-existing postings. Originally designed in response to the 2010 Haiti earthquake (Google, 2012), there were 2,000 reports on Person Finder within a few hours following the earthquake and tsunami in Japan (Nerenberg, 2011). This application was available in both Japanese and English, and users seeking an individual (In/Seekers and Out/Seekers) were able to post information such as the name, and last known location (Preston, 2011). Updates and confirmation of safety could be provided by the sought after individual, or anyone with information about them, such as In/Providers. By the time Person Finder was shut down on October 30, 2011, approximately 670,000 entries had been made, and around 5,000 volunteers had taken part in supporting the initiative (Nerenberg, 2011).

In conjunction with Google's Person Finder, YouTube (which is owned by Google) hosted Missing Person Finder, a video version of the Person Finder. Videos of individuals who had taken refuge in shelters were posted online. Less than one minute each, the videos shared information about who was safely in the shelters, and also allowed individuals in the shelter to request information about missing loved ones (Agence France-Presse, 2011).

Beyond the Missing Person Finder videos, over 9,000 earthquake-related videos and 7,000 tsunami videos were uploaded to YouTube in the hours after the event (Blackburn, 2011). Before mainstream media picked up the videos and rebroadcast them, many of the videos had already been viewed by hundreds of thousands of people

(Wallop, 2011). The videos provided visual and audio information to a wide range of viewers, and allowed both those who were inside and outside of the disaster-affected area to gain a better understanding of the situation.

Acar and Muraki (2011) found that tweets coming from outside of the disaster-affected area were similar to those from within the affected area. Tweets in other areas of Japan included warnings and concerns (Acar & Muraki, 2011).<sup>20</sup> Through the use of social media it was possible for individuals and groups who were outside of the disaster-affected area to reach out to those within the disaster-affected area to provide information and support.

As with In/Providers, social media allowed Out/Providers to play active roles in disaster response, regardless of their geographic location. Out/Providers were able to use social media advantageously to aggregate information being sought and provided by In/Seekers, Out/Seekers, In/Providers and other Out/Providers. Acting as middle-men, they were able collect and consolidate vital information in a way that was easy to access and comprehend. By developing online platforms, Out/Providers were able to disseminate warnings and concerns, and build connections between Seekers and Providers. Out/Providers were able to bring together the different ways that each social network used social media to their advantage.

### **3.3. The Disadvantages of Social Media**

The previous sections in this chapter explored the primary ways in which social media were used during and after the 2011 earthquake and tsunami. All four networks in

<sup>20</sup> Examples of warnings and messages of concern are: “Be careful of the leakage”; “If you’re living in a safe area, do not use the telephone right now in order to give victims the priority of using it. Plus, victims and their families and friends can call 171. At 171, you can record your voice and your family and friends can hear the message”; “I was deeply saddened to hear some people was killed by the earthquake in Miyagi”; “I think the government is concealing something important about the plant. If there’s possibility of melting down, officials should evacuate more people” (Acar Muraki, 2011, p. 401-402).

the IOSP framework sought or provided information, with generally good intentions and positive results. However, there were also examples of how social media was used maliciously, or resulted in intentional or unintentional negative results. This section discusses the ways in which social media was disadvantageous for disaster response during and after the earthquake and tsunami.

A prominent critique of social media in general is that it is not universally accessible (Merchant et al., 2011). One of the groups often left out from participating in technological advancements is the elderly. In Japan, a disproportionate number of victims from the earthquake and tsunami were elderly – 56% of the victims were aged 65 or older (Ryall & Demetriou, 2012). As Mukherjee and Soliman (2012) point out, as age increases, social networks and social support decrease, which puts the elderly at a greater risk when disasters strike. In Japan, it was necessary to physically visit many of the elderly to check on their safety, as they were not otherwise accessible (Inomata, 2011). As well as the elderly, low-income individuals who cannot afford the technology needed to access social media are also left out. It is not possible to conclude in this paper that greater access to social media would have changed the number of individuals injured or the death toll. However, the lack of access to social media does mean that the elderly and low-income individuals were not able to benefit from the advantages social media provided.

An analysis conducted by social media consultant Ayumi Fukaya found that on Twitter, intentionally misleading information, including money-making scams and hoaxes, were a problem immediately after the disaster (Johnston, 2012b). An example of this was witnessed when photos circulated online claiming to be of bodies washed up in the Fukushima Prefecture that were actually photos of the 2004 Indian Ocean tsunami (Johnston, 2012b). Messages falsely claiming to be from the Japan Medical Association warned against going outdoors if it was raining, and claimed that radiation poisoning could be avoided by eating “wakame” seaweed (Johnston, 2012b). Many individuals believed the false information, and reacted accordingly. For example, fears of radiation led to widespread panic buying of iodine tablets, regardless of the fact that radiation levels were not considered a threat at the time (Channel 4 News, 2011). Additionally, some people began drinking wound cleaner iodine, an ineffective and potentially deadly

substitute for iodine tablets (Sternberg, 2011). When false information is spread, it can be difficult to track the origin.

The concern that false information may be intentionally or unintentionally spread made some social media users hesitant to redistribute requests for help from Japan. There were also concerns that messages continued to be distributed among networks after a request had been responded to, prompting additional resources to be sent to deal with a problem that had already been resolved (Acar & Muraki, 2011). False videos with sensationalized titles (e.g. “Japanese Tsunami Launches Whale Into Building”), and forgery e-mails seeking donations for the British Red Cross, circulated online (Cluley, 2011a; 2011b; n.p.). There were also concerns with Google’s Person Finder, and false information being provided on whether or not individuals were safe. In one publicized incident, a man from Australia found that his daughter had been reported on Person Finder as confirmed dead at a hospital in Ofunato, Japan. The father was able to contact friends in Japan, who got in touch with the hospital and were able to determine the post was a fake. Eventually the daughter was able to e-mail her family, but for several hours, her father had believed she was dead (Associated Press, 2011).

The nature of social media allows users to share as much or as little personal information about themselves as they choose, to the point where users can send messages anonymously (Lee & Ma, 2012). Messages are generally uncensored, and information does not have to be vetted before it is published on platforms such as Twitter and Facebook. While this means information is distributed quickly, it is also easier for false information to be spread, such as with the messages that led to the drinking of liquid iodine. In the disaster context, it can be difficult to verify messages, as contact may be lost, or it may be difficult to locate other sources that can confirm the accuracy of the information. Additionally, messages sent through social media are often short – for example, Twitter has a 140-character limit per message (Clark, 2009). This creates the possibility that information is being left out to conserve space, making it more difficult to determine context and assess the level of urgency, as well as the validity of a message (Gelernter & Mushegian, 2011).

Disadvantages with the use of social media in a disaster setting are clearly present in the case study of Japan. As tools for communication, individuals were able to

use social media maliciously to spread false information, and for personal gain. Unintentional misinformation was able to spread through social media networks as fast as accurate and helpful information, and many were left out of the conversations happening through social media altogether. When not used effectively, social media has the potential to increase panic, spread fear, misdirect funds, and misallocate resources. It is important to be aware of how social media can be disadvantageous in order to mitigate the negative effects, and enhance the advantages. These disadvantages do not, however, outweigh the advantages outlined in the previous sections. As demonstrated through the IOSP framework, social media was effectively used in different ways to aid in disaster response, facilitating two-way communication that allowed Seekers and Providers to access and share vital information.

## 4. Moving Forward with Social Media Integration

This chapter begins by exploring the lessons learned from the four networks in the IOSP framework, and their uses of social media during and after the earthquake and tsunami. By examining the uses of social media by each network, it is possible to better understand how social media can be used by disaster responders. Following this, the next steps for further incorporating social media into disaster response are discussed, along with how the lessons learned from the Japan case study can be used to enhance best practices of social media use in disaster settings.

### 4.1. Lessons Learned from In/Out/Seekers/Providers in Japan

**In/Seekers** used social media in a variety of ways, seeking assistance for themselves and for others. Instead of being stranded once phone lines were inaccessible in Japan, social media provided a means of communication. As previously discussed, there were instances of false requests for help being issued and concerns of the misallocation of resources in Japan (Acar & Muraki, 2011). However, in general, disaster responders assess authenticity and require verification before substantial relief efforts are undertaken, regardless of the means of communication being used. The abuse of service providers is also seen with traditional emergency services, which receive prank calls and misinformation (intentional and unintentional) – malicious use is not isolated to social media (Blackstone et al., 2007). Social media are merely another means for individuals to request assistance. The benefits of individuals having additional ways of reaching out for support are more advantageous than the drawback of the increased amount of appeals overall, including false requests. The study of social media in disaster response would benefit from further research into whether or not the proportion of misinformation to accurate information increases with the use of social media.

The concerns of misallocating resources through overlaps in responses to requests for help, noted in the Japan case study, should be dealt with through effective coordination. Disaster response efforts become detrimental and ineffective when there is insufficient coordination and communication among those responding. Social media provide platforms through which disaster responders can effectively coordinate their efforts. The crisis maps created by online groups for the earthquake and tsunami are one way disaster responders can coordinate up-to-the-minute responses. If one organization can verify they are responding to a request and identify it as being addressed, overlap can be eliminated. However, the old adage “better safe than sorry” does apply – until an effective means of verifying which responses have been addressed is well established, it is better for overlapping efforts to take place, than for anyone to be left stranded.

**Out/Seekers** used social media primarily to request information about family and friends who were inside the disaster-affected area, and to raise funds for NGO response efforts. For those seeking information about loved ones in Japan, it was possible to check statuses on social media profiles, as well as find contacts on the ground that knew the missing person. Worried friends and family could be put at ease much quicker than without social media, as multiple sources could be checked for information, increasing the odds that information would be found. While not everyone was able to find the information they were looking for, social media did provide additional avenues for Out/Seekers.

NGOs were very successful in leveraging social media to quickly raise funds. Through the text-to-donate system, as well as messages shared among users through social media platforms such as Twitter and Facebook, word spread quickly. Social media provided a quick and simple way to make an instant contribution to the relief effort. The text-to-donate system was beneficial because it did not require an immediate cash transaction. It was possible for the text-to-donate system to be easily advertised in places such as sporting events, where spectators could reach for their cell phones instead of sifting through their pockets for loose change. It is likely that social pressures also played a role as well; individuals were able to announce their contributions through social media, which may have influenced their family, friends and other members of their social networks to follow suit. There were, however, cases of fake charity scams

attempting to solicit donations through e-mail. Diligence by donors and awareness raising by NGOs can help diminish the potential for fraudulent requests directing funds away from the relief efforts.

**In/Providers** used social media to provide information and assistance from within the disaster-affected area, and re-establish lines of support that were disrupted by the natural disaster. The first line of defence for the Japanese was their government, and the warning systems put in place by the Japan Meteorological Agency. The incorporation of messages sent directly to cell phones meant that individuals were able to receive the message regardless of their location. The government also adopted social media as a way to provide ongoing information to the population, and their messages were circulated online. It was a quick and effective means for the government to reach a wide audience, and provided a forum to respond to concerns and rumours that were circulating online.

Both NGOs and the Japanese government were able to use social media to assist foreigners living in Japan by providing translated information. Through the use of social media, foreigners could seek out the information they required, and were able to find the translated messages online. What was important was that the information was available, and that it was coming from reliable sources. When information was not as readily available, messages from unaffiliated individuals within the disaster area filled the information gap. There were concerns of false information being spread from those within the disaster-affected area. However, the faster that NGO and government communications verified information, the sooner misinformation could be identified and debunked. By monitoring the communications of social media users, it was also possible for NGOs and government bodies to increase their situational awareness.

**Out/Providers** used social media to assist in compiling and vetting information, as well as to share warnings and concerns with the people located in the disaster-affected area. Online groups were able to help establish situational awareness and compile information into crisis maps and other platforms that could be used by all four social networks: In/Seekers could find various locations where assistance and supplies were being offered, Out/Seekers had specific websites they could visit to search for information on missing loved ones, In/Providers could gain valuable information on the

status of infrastructure as well as determine areas where there was the most need for supplies, and Out/Providers could assess what types of assistance were most needed. The online groups worked effectively as middle-men, helping to bridge the gap between Seekers and Providers, and collect information in a way that was easily accessible.

Individuals outside of the disaster-affected area were also in a position to access a wide range of information and help make sure that important warnings reached the individuals who would be most affected by them. It was also possible for the international community to send messages of condolence, support, and solidarity to the people of Japan. Social media provide a level of connectedness across the globe that did not exist when news media shared stories about disasters that happened in far away countries. New networks develop new senses of community that are no longer simply defined by geography.

## **4.2. Moving Forward**

The case study of the 2011 Japanese earthquake and tsunami provides ample evidence in support of the ability of social media to be advantageous for disaster response. The reach of social media can be phenomenal; in a quick message “[o]ne person on a beach can tell hundreds of people around them that a tsunami is coming” (Richard Serino, deputy administrator of the Federal Emergency Management Agency, as quoted in Tucker, 2011; p. 18). The importance of social media, however, does not erase the importance of traditional news sources as well. A survey conducted by Nomura Research Institute in Japan following the earthquake and tsunami found that 36 percent of respondents relied on conventional newspapers, 18.6 percent used the websites of newspapers, and 18.3 percent relied on social media (Johnston, 2012b). This is one reason why disaster responders need to incorporate social media, but not rely solely on this new means of communication.

As noted earlier, organizations and governments have been developing new social media guidelines, and best practices lists have begun to be contrasted and critiqued both by practitioners and academics. As social media adapts and new technologies gain popularity, it will be necessary for these lists to be updated and

practices to be altered. As with most practices, the use of social media will become increasingly standardized over time; disaster responders will adapt their guidelines and practices as they learn from their experiences. What is most important is that social media are not ignored as tools for communication, and that their potential for being advantageous for disaster response is used to the fullest.

The case study of the earthquake and tsunami in Japan provides insight into how disaster responders can better utilize social media, based on the four categories of social networks. As In/Seekers used social media to request rescue, relief supplies and situational awareness, the case study of Japan supports the need for disaster responders to continuously monitor and verify messages sent through social media. By engaging In/Seekers in two-way communication, it is possible for disaster responders to better assess what services are needed, and where they are needed. As Out/Seekers themselves, NGOs were able to quickly generate funds for disaster relief in Japan by providing avenues for individuals outside the disaster-affected area to contribute through social media. By staying on top of social media trends, NGOs can continue to capitalize on soliciting donations from social media users. NGOs and government bodies also play roles as In/Providers, offering services to those inside the disaster-affected area. As noted in the case study, there are concerns with misallocated resources in responding to requests for help. Through increased coordination between In/Providers, which can be facilitated by social media, it is possible to reduce uncertainties and collaborate relief efforts. Out/Providers can also be accessed to assist in the actions of disaster responders, as they were effective in Japan in establishing crisis maps and missing persons databases. By fostering relationships with Out/Providers prior to disasters, disaster responders will have greater access to vetted information that can speed up their disaster response.

While organizations and governments have begun to create and adhere to guidelines and best practices for the use of social media in disaster response, the same cannot be said for online groups. While these groups were able to collaborate and work effectively in the Japan case study, in the future, disaster responders can establish working relationships with them to increase professionalism and assist in establishing standard practices. Though there are also very few mandatory rules on social media sites for individuals, attempts to create standards have been made. Following the

earthquake and tsunami in Japan, a Communication Consultant developed a list of best practices for Twitter users. The list includes: only sharing information from trusted sources, checking for more recent information, asking for verification, and correcting any mistakes (Jerbi, 2011). By distributing lists such as these through social media networks, disaster responders can help encourage responsible use of social media by individuals. As demonstrated in the Japan case study, the majority of individuals had good intentions. When misinformation was spread online after the earthquake and tsunami, many individuals worked to debunk the rumours<sup>21</sup> and share verified information. By cultivating trusted individuals to assist with vetting information, disaster responders can harness the desire of people around the world to participate in disaster response.

As noted by Craig Fugate, director of the Federal Emergency Management Agency, "We're trying to reconceptualize emergency response around resources that didn't exist five years ago...[w]e've got to stop looking at the public as a liability and start looking at them as a resource" (Sternberg, 2011). The Japan case study has demonstrated that the two-way communications facilitated by social media are advantageous for disaster response. This section has identified the lessons learned from the earthquake and tsunami, and identified how disaster responders can move forward with the incorporation of social media into their disaster response strategies. As social media continues to gain popularity, their importance in disaster response will continue to grow.

<sup>21</sup> Examples of rumours debunked by individuals online include the previously mentioned images of the 2004 Indian Ocean Tsunami and the consumption of iodine (Johnston, 2012b).

## 5. Conclusion

During and after the earthquake and tsunami in Japan, social media were widely used to facilitate two-way communication and the coordination of relief efforts. Social media were used differently by four categories of social networks: In/Seekers, Out/Seekers, In/Providers and Out/Providers. While the use of social media did produce some negative results, overall their use was advantageous for disaster response. This paper has focused on the use of social media by individuals, online groups, NGOs, and government bodies. The case study of the earthquake and tsunami in Japan provided an overview of how social media were used by different social networks, and what they were used for. In/Seekers requested rescue for themselves and for others, sought information on the environment and post-disaster situation, and asked for relief supplies. Out/Seekers searched for information about family and friends, as well as raised funds for relief efforts. In/Providers sent out earthquake and tsunami warnings, provided information on where assistance could be accessed, and shared information about the environment and post-disaster situation. Out/Providers collected and vetted information, as well as shared warnings and concerns. While these uses were advantages for disaster response overall, the disadvantages of misinformation, malicious use and attempts at personal gain were also present. Both during and after natural disasters, social media have the potential to be powerful tools coordinating relief responses, connecting individuals to resources, and engaging a wider community beyond those directly affected.

Despite the fact that misinformation was intentionally and unintentionally spread, and that social media were not available to everyone who was affected by the earthquake and tsunami, this paper has demonstrated that social media were used to facilitate the sharing of vital information. By better understanding how social media were used by the different networks identified through the IOSP framework, this paper provided insight into how disaster responders can interact with different networks to enhance their responses. This paper demonstrated how the IOSP framework can be

employed to explore social networks utilizing social media, and the findings from this paper can be used as a stepping stone for the development of disaster specific social media tools.

Further research is needed in order to better determine the best uses for social media, and how different NGOs and government bodies responding to natural disasters can capitalize on social media's benefits. The collection of information shared through social media while a natural disaster is taking place, and directly after, will provide data for a detail-rich analysis, as well as the possibility for both qualitative and quantitative research methods. The temporal and linguistic limitations that this research faced could be overcome by the immediate collection and archiving of social media messages, which necessitates immediate action by researchers as soon as a natural disaster takes place. Additionally, the services of a translator, or involvement of researchers familiar with the language and culture of the disaster-affected area, would enrich the depth of analysis by allowing for access to more information, and providing cultural context to the disaster-affected area.

As pointed out by a director of communications in the US, it is important to "try to bring your information to where the people are" (Tucker, 2011; p. 18). As previously mentioned, at the beginning of 2012, there were more than 800 million active Facebook users, and more than 100 million active Twitter users (Daniells, 2012). There is clearly an easily accessible population using social media who can be contacted and mobilized. People are no longer browsing static websites for information, but are using applications and mobile browsing for a dynamic experience (Crowe, 2010). By tapping into this population and drawing on their strengths and resources, disaster responders can enhance their efforts, and improve their ability to act swiftly and effectively when disaster strikes.

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