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LEVERAGING SOCIAL MEDIA AND EMERGING TECHNOLOGIES IN DOMESTIC
DISASTER RESPONSE SUPPLY CHAINS AND LOGISTICS

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ABSTRACT

The idea of social networks leveraged as a solution to improve visibility stems from the realization that individuals around the world are now interconnected through technology at an unprecedented level. In the purest form, social networks are tools used to facilitate peer-to-peer collaboration, including social media and emerging technologies. This research evaluates how these technologies are being used within disaster relief, in order to explore the potential of social networks in serving as a fabric for visibility and interoperable communications in disaster response supply chains.

This thesis features a culmination of unique perspectives formulated through interviewing representatives in each major category of emergency management stakeholders, including Government Emergency Management agencies, Non-Profit Organizations, Military, and Private Sector. A literature review was also conducted for a current state analysis of research in this realm, as well as input from practitioners and experts in technology and disaster relief through interviews. The outcome of this research reveals three key elements that demonstrate the value of social media and emerging technologies; the expeditious flow of bidirectional information to the right person, at the right place, at the right time, and providing a critical tool for responders to aid in decision making. In addition, interview respondents ardently discussed the essential nature of shifting the general perception of these technologies within the realm of disaster response. Through establishing a decision-making framework, this thesis provides suggestions for disaster relief stakeholders seeking to develop a social media and emerging technology strategy.

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Chapter 1

Introduction

Weather patterns are becoming increasingly erratic. In 2013, a massive tornado raked through Oklahoma, catastrophic floodwaters spread throughout Colorado, unruly wildfires blazed through Arizona, and an earthquake shook Alaska. What do these domestic disasters all have in common? They highlight the need for clear, reliable, and concise communication to people in order to help save lives. As a result of this growth in natural disasters, and consequently more citizens at risk, it has become increasingly essential for those involved in disaster management to ensure seamless communication throughout their operations. Distributing relief goods efficiently is the main objective and a key challenge in the management of disaster relief (O. Balza, 2011). At the forefront of achieving this goal is supply chain management, which assumes the role of rapidly providing relief goods from different sources to the destinations where they are needed.

A key challenge that has been observed in the realm of domestic disaster relief is the lack of communication between disaster responders, as well as the public. This challenge is perhaps most detrimental since after a natural disaster occurs, a variety of actors converge efforts with the common goal of helping affected people and communities to alleviate suffering and death. These actors span from government emergency agencies (local, state and federal), non-profit organizations, donors, the military, and private sector companies. Given the diversity of actors involved and the timely nature of response efforts, effective communication and coordination is essential. Disaster response supply chains are focused on matching the needs of affected communities with the response capabilities of actors responding. In a world of networked intelligence where affected communities have the capability to communicate their needs directly

and where the response organizations can easily communicate with each other, could virtual social networks, such as social media and emerging technologies, serve as a valuable means of coordination?

Social Networks in Disaster Relief Communications

Social networks have been defined in several ways. Essentially, it is a platform uniting individuals, groups, and societies based on dyadic ties. In particular, social media is often used to transmit information with a broad audience, which has supported the unprecedented migration of users in recent years that have expanded the traditional social networks into the online realm (White, 2011). Its value has expanded far beyond the original purpose and intended use, and continues to be leveraged in innovative ways to enhance communication. Previously, the value of social networks has been recognized in hindsight. However, in recent years, it has been utilized as an essential disaster-planning tool. The value created by social networks through leveraging social media and emerging technologies have been revealed during recent responses such as Hurricane Sandy and Katrina, as well as man-made disasters. The timeliness of social media channels offers a unique advantage in comparison with traditional forms of networks such as television, print or radio stations. It offers a method of fulfilling the mission of first responders, emergency managers and planners by supporting a network of information sharing across organizational boundaries (Mergel, 2013).

The value of leveraging social media and emerging technologies has the potential to reach all constituents involved in supply chains during a crisis. As an emergency operations manager, one could mitigate the suffering and deaths in affected communities, both by accessing timely information through the knowledge exchange among constituents and citizens, as well as

by leveraging a mass warning tool. As a procurement manager, imagine a world where one is able to minimize unmet needs by forecasting based on timely updates received by consumers and other disaster relief actors, which is essential given the level of uncertainty during disasters. In the transportation and logistics realm, the ability to receive timely updates regarding traffic, weather alerts and infrastructure damage could minimize inventory losses and aid in ensuring the safety of responders. In the world of warehouse management, given the fact that many organizations preposition inventory to aid in a rapid delivery to areas affected, one might relish the ability to coordinate with other actors in distributing supply sources, which is crucial given the time-critical setting of disaster relief.

Scope and Focus

Given the vast world of humanitarian aid, which spans from natural disasters to man-made, occurring both domestically and globally, it is important to narrow the focus of this research to provide an in-depth analysis. This research will consider natural disasters occurring in the United States to limit the categories of disasters, as well as variables associated across borders. Furthermore, four fundamental phases define any emergency management relief effort: Mitigation and Preparedness (pre-disaster), Response (during disaster) and Recovery (post-disaster) (FEMA website, 2011). Although this research will include a brief analysis of each phase, it will be centralized around Response phase, due to the elevated importance of timely communication and efficiency in coordination.

The foundation of this research regards social media and emerging technologies, within the context of disaster management communications, as tools that support the flow of information between emergency managers, disaster victims, traditional media sources and the

general public through an interconnected digital web of social networks (O. Balza, 2011). Social networks in general will be analyzed to gain a broader picture of their potential in the realm of disaster relief supply chains during the Response phase. This analysis will limit the scope of social networks to those that serve as platforms in supporting the flow of information.

Chapter 2

Literature Review

A literature review was conducted to analyze the use and extent of social media and emerging technologies in various aspects of disaster response. It will feature a compilation of publications, journals, books and website sources in summarizing the research. These means of communication have been under the lens of researchers and can be separated into two primary streams that investigate the value and logic of using these social network tools in emergency response. One stream is concerned with how those affected by disasters leverage these technologies as a source of information, as well as to seek and provide support (Latonero, 2010). The other stream of research is how disaster relief constituents use such tools to communicate and collaborate during the response phase of a disaster. (White, et.al., 2009). In order to illustrate these streams, a current state analysis was conducted to present a few social network tools leveraged in collaboration among the five main constituents in any domestic disaster response effort: government emergency agencies (local, state and national), non-profit organizations, donors, the military, and private sector companies.

Three key themes were revealed through this literature review. First, the use of social media and emerging technologies among emergency response constituents in responding to disasters continues to evolve as innovative approaches emerge. Second, social networks, including social media, have served as an excellent medium supporting the information flow

among constituents. Lastly, social networks are gradually integrating into existing technology, as well as applied on their own, to improve visibility and efficiency.

Real-Time Emergency Response

Findings from previous research have revealed that perhaps the most important and unique value of social media is the ability to provide a collaborative electronic space, with the potential to support rapidly changing, real-time emergency response needs (White, 2008, 2009; Latonero, et.al, 2010; Jongejan, et.al, 2012; Helsloot and Groenendal, 2013; Mergel, 2013). This leads to an opportunity to leverage such tools to gain immediate access to disseminate real-time information for timely decision-making. As White details, “When combining the ability to disseminate information to a network of people online, with the ability to have this initial group extend information in a variety of other electronic and non-electronic ways to reach those networks that are online, demonstrates the foundation upon which social media can be further leveraged” (White 2011).

Ample research in recent years continues to emerge related to the potential of micro-blogging during disasters, where users can broadcast short messages to communicate with their network of specific people, or “followers” (Tapia, et.al, 2013; Latonero, 2010). Perhaps the most common tool featuring this form of communication is Twitter, which gives users the “unprecedented ability to broadcast and exchange small amounts of information with large audiences, regardless of distance, fast” (Latonero, 2010). The majority of research related to its usage in emergency response discussed the aforementioned first stream of research, as a mass notification system with timely updates.

Initially, the research in this realm was centralized around Twitter as a forum for communication to the public from the perspective of emergency responders (Latonero, 2010; Terpsta, et.al, 2012). However, the latest research has broadened its value to include emergency as a platform for bi-directional communication between the public and emergency responders (Latonero, 2010). Latonero provides a broad overview of the two-way nature that Twitter provides in stating that emergency response managers leverage Twitter to “disseminate real time information, as well as monitoring Twitter messages during the crisis to allocate resources based on that information” (Latonero, 2010). The micro-blogging site has also been distinguished as an outlet for crisis managers to directly interact with citizens and media by confirming or refuting rumors, as well as factoring in emotional responses into account in their crisis communications (Terpstra, 2012).

In regards to the second stream of data, research has shown the potential ability of both Twitter and other social media tools to serve as a conduit in cross-agency communication through providing information from other responders, city officials, and utility companies (Mergel, 2013). Dr. Ines Mergel, a social media researcher, notes that it has been recognized for “supporting wider network of information sharing across organizational boundaries.” Franke concurred that a series of information system tools are necessary in the ad-hoc nature of coordination in disaster response, “[...] it is very difficult to track the current status of activities or to detect conflicting views on a situation, [...] Furthermore, every time the status of an activity changes all relevant stakeholders of an activity have to be found from scratch in a huge pile of messages” (Franke, 2011).

Bridging of Knowledge

Social media aids in emergency responders' efforts to get the right information to the right people at the right time (White 2008). Such tools are providing a better form of crisis collaboration that is likely to propel those who utilize its value with increasing speed in communication. Recent research has revealed this value both inter-organizationally and intra-organizationally. In terms of communication among organizations, managers have been able to simultaneously alert different agencies with situation report updates. This has been proven to be essential in assessing what has been done and what needs to be done to avoid duplicate efforts (O. Balza, 2011).

Despite the ample research supporting the value of social media in the emergency management realm, the extent to which constituents implement such tools as a best practice remains inconsistent. The roots of their apprehension to leveraging social networks will be discussed during the background portion of this paper, as well as through conducting interviews. However, it is important to note the findings in research that provide a broad analysis of the current state and general perspectives among constituents.

One of the ways in which constituents utilize social networks is in pushing vast amounts of information to each other and the public (O. Balza, 2011, Base, 2012, Yasin, 2010, Corbin, 2012, White, 2011). It supports the sharing of data and ability to issue warnings and closures, as well as an ad hoc warning response (White, 2011). The constituents that continue to embrace social networks as a best practice span both nonprofit organizations, such as the Red Cross, to governmental organizations, such as FEMA and other emergency agencies at all levels. For example, during the month of September in 2013, Twitter collaborated with two disaster relief

constituents, FEMA and the Red Cross, in harnessing the social network's tool for emergency communications by creating "Twitter Alerts." This system is designed to allow enhanced visibility to organizations involved in all stages of humanitarian relief by providing an outlet to communicate with the public. "It is intended for crises, disaster and emergency communications such as warnings of imminent dangers, preventive instructions, evacuation directions and crowd management" (Miners, 2013). The alerts serve as a reliable source of information that is disseminated on a global scale. The Obama administration launched a Transparency of Government campaign that aimed to leverage social media platforms in supporting all federal agencies in emergency management. The Department of Homeland Security use Twitter, Facebook and YouTube to provide services for both first responders, and citizens (White, 2011). Other constituents have recognized the full potential of these tools through both monitoring information and analyzing data as a vital aid in decision-making. It has been noted that leveraging social networks during times of emergency provides a "flatter, less hierarchal approach for information sharing" (Yasin, 2010). The Chief of the Federal Emergency Management Agency (FEMA) professed the benefits of social media due to its ability to bring the information to the decision maker versus the decision maker having to locate the information themselves (White, 2011). Other benefits have been identified as serving as an ideal medium to introduce dialogue on new or emerging issues, a forum for best practice sharing and the flexible ability to aggregate various forms of media such as text, videos and pictures (White, 2011).

Integrated Technology

Thorough research on social networks in various formats has revealed that its' application continues to transcend the original use. In regards to disaster response, it has been leveraged to

extract essential data from the social media tools in real-time situations. Leveraging social media in through integrated technologies has been recently examined in different formats (Terpsta, 2012, Yasin, 2010)“Visual features like graphical displays of tweets over time and maps of tweet locations [...] help to identify abnormalities in the twitterverse that may be worth analyzing” (Terpstra, 2012). This research has revealed the potential value of integrating social networks tools in order to monitor and determine where to focus the disaster relief efforts. The Director of Operations at the Virginia Department of Emergency Management, Harry Colestock, noted the potential of “integrating numerous information systems and social networks to transform how constituents prepare for emergencies and respond to disasters” (Yasin, 2010). Streamlining the process of aggregating information in times of a disaster leads to better situational awareness.

Few organizations have illustrated this area of research. The American Red Cross dedicated an entire Digital Operations Center to glean valuable information published on social media tools. By charting and monitoring the Twitter and Facebook activity, as well as other blogging forums, during times of emergency by aggregating conversations and displaying visuals such as heat maps to gain insight into victim’s needs (Corbin, 2012). According to the president and CEO, Gail McGovern, “Information is like gold. The Red Cross leverages social networks data as a tool to spot trends that could indicate where needs are likely to arise in an emergency zone and to engage victims to connect them to food and water” (Red Cross Press Release, 2013).

Discussion

This literature review demonstrates that social networks are appropriate tools for an information exchange between constituents. Visibility allows constituents to monitor information

that leads to the efficiency in allocation of materials. However, due to the essential nature of visibility specifically within disaster relief supply chains, the potential of social networks in the coordination in this realm involved among constituents presents an opportunity for further exploration, which is the gap in research that this thesis will address. The next chapter will provide an overview of the core terms necessary to delve deeper in this analysis, as well as provide a description and analysis of each constituent involved in disaster response.

Chapter 3

Background

Frames of Reference

In order to delve into the role of social networks in disaster relief supply chains, it is essential to fully understand the background supporting this area of research. This chapter includes terms and definitions that describe the concepts and paint a picture of the relationships connecting disasters, disaster management, and social networks.

Disaster Management

The term ‘disaster’ is a word that may cause one to conjure up an array of images, like the devastating loss of thousands through acts of nature and humans. Researchers and experts have defined the word in multiple ways throughout literature. For the purposes of this paper, the definition will be, “any event, typically occurring suddenly, that causes damage, ecological disruption, loss of human life, deterioration of health and health services and which exceeds the capacity of the affected communication on a scale sufficient to require outside assistance. (Landesman, 2004). In this paper, ‘disaster’ and ‘emergency’ are used interchangeably, although some research has differentiated the two terms based on slight nuances. Both of these events belong in the “un-ness” category: undesirable, unimaginable, unmanageable and unexpected

situations (Altay, 2008). According to disaster experts, the element separating disasters from emergencies revolves around demand and capacity. Unlike the definition of disaster above, an ‘emergency’ occurs when “capacity is challenged by demand, but local assets are able to manage the demand” (Rodríguez, 2008).

Categorizing Disasters

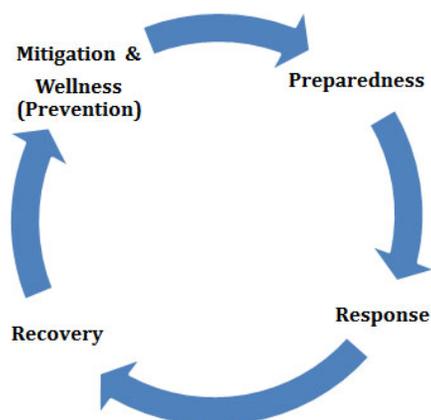
		Source	
		Natural	Man-made
Speed of Onset	Sudden	Earthquake Hurricane Tornado Tsunami	Terrorists attack Coup d'etat Chemical Leak
	Slow	Famine Drought Poverty	Political Crisis Refugee Crisis

Figure 1: Categorizing Disasters

(VanWassenhove, 2006).

The cause of a disaster can be distinguished between natural and man-made. In regards to the predictability and speed of an occurrence, disasters can be further distinguished between a sudden-onset and a slow-onset disaster, which are depicted in Figure 1 (Van Wassenhove, 2006). The focus of this research is natural disasters, which are defined as the “sudden upheaval of nature, causing extensive destruction, death and suffering among the stricken community, and which is not due to man’s action” (Rodríguez, 2008). Almost all natural disasters are a consequence of events such as storms (hurricanes, cyclones, floods), earthquakes (shaking, liquefaction, tsunamis, landslides) and volcanic eruptions (Kieffer, 2013)

Disaster management is often described as a process that captures various phases of a disaster (Figure 2). Most literature concurs on the classification of the following four phases,



although disagreement exists among authors regarding the terminology and structure of the stages (Van Wassenhove 2006, Cozzolino, 2012, Kovács and Spens 2007, FEMA website 2013).

Figure 2: Four Phases of Emergency Management

Mitigation:

The Mitigation phase of a disaster involves preventing future emergencies, or seeking to minimize their effects. Activities during this phase take place both before and after emergencies (FEMA Training, 2011). These activities from the perspective of a constituent involved could be instituting laws and mechanisms to reduce social vulnerability (Cozzolino, 2012). The objective during this phase provides a solid foundation in the effort to reduce the destruction of both life and property by lessening the impact of a disaster (Ada Emergency Management, 2013).

Preparedness:

This phase refers to various activities that occur prior to the emergency in preparation. This involves gathering information about possible risks and building plans in order to save lives and aid in the response and recovery efforts before an emergency occurs. During the preparedness phase, constituents incorporate the efforts made during disasters to adopt best practices that will

aid in meeting new challenges (Cozzolino, 2012). The cycle of planning, organizing, training, equipping, evaluating and taking corrective action to ensure effective coordination during an emergency is continuous (Ada Emergency Management, 2013). From a supply chain perspective, the logistics involved include “community capacity building in terms of having functional early warning systems with trained and equipped response agencies” (O. Balza, 2011). In addition to these systems, the prepositioning of emergency response supplies and the building of capacity within organizations is essential to ensuring adequate preparation (Howden, 2009). In sum, the goals in this phase include: the knowledge and capacity of those involved to effectively anticipate, respond to, and recover from the impacts of a disaster (UN Terminology, 2009).

Response:

The safety and well-being of citizens depend on how prepared disaster relief organizations are to respond to a crisis (FEMA Training, 2011). In order to expand this phase, research has divided disaster response into three phases (Tomasini & V. Wassenhove 2006). First, the “ramp up” phase entails emergency responders immediately implementing plans that should have been established during the previous two phases, such as distributing essential necessities of life to affected populations (Rahman, 2010). The short-term and direct effects of the disaster are the focal points during this phase, which is often referred to as disaster relief (UN Terminology, 2009). The following phase is “sustainment” or “restoring” which involves the ongoing assistance to revitalize the basic services of those affected, as well as to ensure a timely delivery of goods to beneficiaries. The final phase is known as “ramp down” (Rahman, 2010), or the “transition phase,” (Howden, 2009) includes deploying assets and teams as the need for assistance diminishes (UN Terminology, 2009). General objectives in this phase include taking

actions to save lives and to prevent future damage and destruction (Ada Emergency Management, 2013).

Recovery:

This phase includes the development, coordination, and execution of activities to return to conditions of their lives before the disaster. This task begins soon after the emergency phase and response efforts have subsided, which is not well defined, and should be based on pre-existing strategies (UN Terminology, 2009). Terminating the disaster relief efforts involves downsizing operations in order to regress to routine mode from emergency (Altay, 2008). The goal in the phase is to restore and improve the livelihoods and living conditions of disaster-affected conditions (UN Terminology, 2009).

Humanitarian Assistance versus Disaster Relief

The key objective in both humanitarian assistance and disaster relief efforts are to “save lives, alleviate suffering and strengthen human dignity during and in the aftermath of [...] disasters, as well as to prevent and strengthen preparedness for the occurrence of such situations (Rahman, 2010). However, the differentiating factor is the scope of the disaster that occurs. Disaster relief typically refers to a domestic occurrence, within US boundaries, which humanitarian assistance is global in scope. Within disaster relief efforts, effectiveness is key to ensure that those involved are able to save time and, as a result, human lives. However, several characteristics of a relief environment create a challenge in planning and coordination during disasters. (Balcik, Beamon, Krejci, Muramatsu, and Ramirez, 2010). First, the sheer number and diversity of actors involved adds complexity to the operating environment of disaster relief.

Although these constituents share the same goal of alleviating suffering, the motives and operating constraints may differ among those involved. Secondly, many relief organizations heavily rely on donor funding, which adds another level of uncertainty in the execution of activities within relief organizations. The scarcity of resources presents an additional challenge in meeting demand with available supply. Lastly, the overall cost of coordination has stifled relief organizations (Stephenson, 2005).

Supply Chain Management and Logistics in Disaster Relief

The importance of supply chain management in disaster relief stems from the measure of a successful disaster relief operation, which is to “mitigate the urgent needs of a population with a sustainable reduction of their vulnerability in the shortest amount of time and with the least amount of resources” (Tomasini and Van Wassenhove, 2004). By definition, supply chains in this context are vital networks that maintain the flow of goods, information and cash between the actors and beneficiaries in times of a disaster (O. Balza, 2011). There is a distinction between supply chain management and logistics that must be noted. Disaster relief logistics is “planning, implementing and controlling the efficient, cost-effective flow of and storage of goods and materials as well as related information from point of origin to point of consumption” (Thomas and Kopczak, 2005). From a supply chain management point of view, in a disaster context, it is essential to sustain a relationship among the actors involved through an “integrated approach to efficiently and effectively coordinating inter-organizational performance, eliminating redundancy, and maximizing efficiency along the entire emergency supply chain” (Cozzolino, 2012). Logistics is more focused on executing the movement of something from origin to

destination, while the supply chain is focused on relationships among actors that are essential in facilitating this movement.

The following characteristics bring complexity and unique challenges in this realm that have been revealed through literature:

- Complex operating conditions (van Wassenhove, 2006)
- Disruption in critical infrastructure
- High stakes associated with timely delivery
- Limitations in transportation resources
- Availability of resources (supply, people, technology, transportation capacity and money) (Balcik, Beamon, 2008).
- Uncertainty of demand and supply
- Large number of stakeholders
- Unreliability or incomplete influx of information (Altay, 2008)

Some of these issues are inherent and inevitable given the nature of disasters, such as the complex operating conditions, time pressure and availability of resources. However, other aforementioned issues could be resolved through the application of two supply chain principles: agility and leanness. Agility is the ability to respond in times of uncertainty, and leanness is doing things more efficiently with fewer resources when demand is relatively stable (Cozzolino, 2012). In the disaster response realm, the application of these principles depends on the sub-stage of the response phase. In the “sustainment” phase, the objective is to save time and mitigate the damage caused, which can be achieved through agility. During the final sub-stage of disaster response, the ‘ramp down’ phase, the goal is the save costs, which can be achieved through leanness (Cozzolino, 2012).

Information:

Coordinating and communicating in this environment is far from a trivial task. During times of disaster, there is a paucity of information. It is difficult to ascertain the number of survivors and the imminent needs of the affected community. Distribution becomes a challenge as uncertainty resonates at all levels in the supply chain. During Hurricane Katrina, disaster response efforts were hindered by “lack of coordination, poor information flows and the inability of disaster response managers to validate and process relevant information and make decisions in a timely fashion” (Altay, 2008). The sheer amount of variables complicates the flow of information and certainty in decision-making.

Recent trends in the disaster relief supply chains have revealed that actors will be facing market pressure to increase efficiency and effectiveness (Majewski, 2010). The most immediate opportunity that has been revealed is leveraging information technology in increasing transparency to reduce inefficiencies, to ensure timeliness in mobilizing and delivering essential goods (Majewski, 2010).

Disaster Relief Constituents

The goal of analyzing the constituents is to first gain a broader understanding of those involved in a domestic disaster relief effort, and then to depict which information is necessary during the response phase and how it flows throughout the organization. This will provide an overview of how decisions are made. Disaster response supply chain management engages a diverse range of actors, with different agendas, capacity, expertise and interests. The key actors can be categorized as followed: governments, military, donors, non-profit organizations and

private sector companies (Cozzolino, 2012). Research has revealed that these constituents need different sorts of information needs depending on the type and phase of disasters. According to Tapia et al., at the onset of a disaster, constituents need to gain information about the context and scope of an emergency. During the disaster response phase, they need information to fill gaps in availability of emergency resources. In the recovery phase, information is necessary to coordinate operations, and regular updates are essential in receiving status updates, and sustaining inter-organizational coordination (Tapia, Moore, Johnson, 2013).

Government

Governments at all levels, federal, state and local, have an essential role in emergency management. In coordinating responders on each level, the Department of Homeland Security (DHS) mandated that all agencies adopt the National Incident Management System (NIMS). This provides an integrated framework for first responders during emergencies. The NIMS describes agreements that should exist among responders in emergency relief to assist across jurisdictional boundaries called 'mutual aid' (FEMA NIMS courses, 2014). This aid is established either once a disaster occurs, or a formalized agreement.

NIMS establishes how information should be managed through the information management concept. Typically, the Incident Commander, generally the most experienced responder, identifies the resources required, and then communicates these needs to the local Emergency Operations Center (EOC). Crucial to emergency management, each EOC is a physical location staffed by cross-organizational personnel at all levels of government, with the ability to analyze information, communicate with various responders, and manage resources. The

local EOC either fulfills this needs, or requests assistance through the mutual aid agreements with private sector and nongovernmental/non-profit organizations (FEMA NIMS courses, 2014). If States are unable to meet these needs, they may request support from other states through an Emergency Management Assistance Compact (EMAC) or nongovernmental organizations (FEMA NIMS courses, 2014). If additional support is needed, Federal assist may be requested.

Built on the framework of NIMS, the Homeland Security Act of 2002 mandated that the National Response Framework (NRF) be established as a comprehensive approach to all domestic incidents (Environmental Protection Agency website 2014). It aims to “enable effective interaction among various federal, state, local, tribal, private-sector, and other nongovernmental entities” (Environmental Protection Agency website 2014). The most recent edition, updated in 2013, focuses on the whole community, including the increasing role of the public, the core capabilities (DHS National Response Framework, 2013). Various responders have embraced the ‘whole community’ approach upon recognizing that everyone is able to contribute value, and benefit from these efforts.

As a subcomponent to this directive, the Incident Command System (ICS) was established in the 1970s as an all hazards approach to incident management (FEMA ICS, 2013). Its purpose is to enable a coordinated response among various constituents, standardize planning processes and facilitate the integration of resources within a common organizational structure (FEMA NIMS courses, 2014). This system is used for a wide range of hazards, ranging from natural disasters to technological and man-made hazards. It aims to avoid the poor communication and lack of integration among responders that typically plagues disaster response efforts. The flow of communication is top-down through a command and control structure, although information is exchanged freely within the structure of ICS (FEMA NIMS courses,

2014). Each constituent coordinates its end goals to collaborate in forming a common goal to be included in the Incident Action Plan, which also instills accountability. In order to ensure interoperability, communications are integrated to create a common communications plan.

Federal Government Agencies:

Federal Emergency Management Association (FEMA):

FEMA assumes the lead role in supporting the government, with the mission of “supporting our citizens and first responders to ensure that as a nation we work together to build, sustain and improve our capability to prepare for, protect against, respond to, recover from, and mitigate all hazards.” (FEMA website, 2014). FEMA became part of the Emergency Preparedness and Response Directorate of the Department of Homeland Security in response to the terrorist attacks on 9/11/2001. FEMA is responsible for coordinating disaster relief efforts among federal, state and volunteer organizations (Base) When a disaster occurs that exceeds the capability and resources of local and state governments, the “Stafford Act” grants FEMA the authority to lead disaster response operations upon a presidential disaster declaration (Base, 2012). FEMA then works with the Federal Coordinating Officer of the affected state, who is responsible for coordinating relief efforts to ensure the flow of information is maintained (Grabianowski, 2005).

Federal disaster relief is divided into 15 Emergency Support Functions (ESFs), which are specified in the Federal Response Plan. These exist as the primary coordinating structures on the Federal level, with the objective of managing and delivering resources (Grabianowski, 2005). Each ESF is led by difference agency or agencies. For example, as of 2013, FEMA is the lead agency for the five emergency support functions (Grabianowski, 2005). From a logistics

standpoint, FEMA's role includes managing warehouses and four distribution centers that are located across the nation, storing between six to either commodities ranging from bottled water to high-end power generators (DeLissio interview, 2014).

Donors

Donors provide the majority of the funding necessary for relief activities. There are two forms of this financial assistance: "in-cash donations" to support disaster relief efforts, and donating goods and services, or "in-kind donations." The term "donor" exclusively refers to "in-cash donations" and is an essential flow of finances (Cozzolino, 2012). Donors also include both individuals and companies. Disaster relief supply chains must ensure an effective flow of money from these sources in order to effectively respond to a disaster with the appropriate resources.

Given this dependency on donors for relief assistance, especially among non-profit organizations, it is essential to address potential threats that may present obstacles in this flow of funding. One of these threats is the lack of communication to donors' understanding the needs of agencies. Third party programs, such as Aidmatrix and Global Impact, facilitate coordination by providing solutions dedicated to matching private and individual donors to the needs that are specific in the field by disaster relief agencies (Tomasini, 2009). Aid Matrix has partnered with about 35,000 agencies worldwide to allow communities to share information more easily, and will be discussed in the 'Nonprofit' section (AidMatrix website, 2014). Global Impact sustains relationships with agencies to provide their needs in online catalogues to donors (Tomasini, 2009).

Nonprofit/Non-Governmental Organizations

Although nonprofits/NGOs constitute one category of constituents involved, they include a diverse range of disparate actors, with various capacities. Non-governmental organizations typically refer to voluntary, faith-based, and community-based organizations within the civic/nonprofit sector. Some of these organizations are created to assist multiple disasters, while others are created solely for a particular disaster (FEMA NIMS courses, 2014). The National Voluntary Organizations Active in Disaster (NVOAD) is a nationwide coalition of organizations that collaborate in each disaster phase to assist communities in disaster preparedness and disaster response (FEMA ESF, 2008). NVOAD has a supporting agency role in the ESF 6: Mass Care, which specifies that they must facilitate communication and information sharing among members in planning and preparing for disaster incidents (FEMA ESF, 2008).

The American Red Cross:

The most prominent organization included in NVOAD is The American Red Cross, which aims to provide compassionate care to those in need through wide ranging service areas such as Disaster Relief, supporting America's Military Families, Blood Donations, Health and Safety Services, and even extending their influence beyond U.S. borders through international services (Red Cross website, 2014). It serves as both a nonprofit organization, given the source of funding, as well as a federal agency, as an emergency support function under the National Response Plan. The organization has a co-agency role for the ESF 6: Mass Care, in which they share responsibility with FEMA and the Department of Homeland Security for coordinating essential resources, emergency assistance, and temporary housing to provide life-sustaining assistance to victims (FEMA ESF, 2008).

Its role as an ESF includes supporting core capabilities such as Planning, Operational Coordination and Public Information and Warning. Among the three lead agencies, from a supply chain/logistics viewpoint, the American Red Cross is responsible for providing support such as “identifying available mass care capacity, anticipating requirements and establishing strategies to address any gaps in coordination among Federal agencies, NGOs, and private sector partners” (FEMA ESF, 2008). Another responsibility includes providing critical disaster relief and preparedness information to the public through proactive media (FEMA ESF, 2008). In fulfilling this action, the Digital Operations Center (DOC) serves as a central communication hub for disaster response in facilitating coordination among agencies across all levels, from local, such as police forces, to state and federal agencies (American Red Cross, 2013). This DOC is capable of undergoing tasks such as assessing damages of affected areas, organizing warehousing and stations with resources, and opening shelters as necessary (American Red Cross, 2013).

The Aidmatrix Foundation

The Aidmatrix Foundation is a nonprofit organization that offers supply chain, volunteer management, and fundraising technologies for those involved in supply chain of humanitarian relief (Aidmatrix website, 2014). Aidmatrix received a grant from FEMA to build The Aidmatrix Network, which would serve as a platform connecting governments, donors and nonprofits as a national network for humanitarian aid. These platforms include capabilities allowing responders to “procure, manage, and deliver through real-time coordination, coordinate humanitarian relief between public and private sectors, as well as empower interactions with corporate donors for collecting overflows and converting inventory into goods available to local agencies” (Aidmatrix website, 2014).

As a partner of AidMatrix, the American Logistics Aid Network engages the supply chain industry in order to address the unmet needs of relief organizations, people and communities in disaster relief. Through leveraging the AidMatrix web portal technology, ALAN Aid created a web portal to match assistance with specifically requested needs. This technology allows relief organizations to post needs for ALAN member supply chain companies to browse and determine areas where they can assist. They utilize Facebook, Twitter and BlogSpot in order to provide timely updates to the needs expressed in the web portal, as well as raise awareness of various methods of helping the organization.

Although there are several advantages to this system, government agencies have been slow to implement this network for a few reasons. According to a FEMA representative, there is a higher level of expectation for government agencies, such as having pre-existing relationships with suppliers to provide timely resources, as opposed to matching the needs real time. For example, the state of Florida has a warehouse stocked with supplies needed in the event of a disaster. Although the Division of Emergency Management could probably procure these items at a moments notice, the probability of failure outweighs this efficiency in procuring materials (Koon interview, 2014).

Military

Military forces have traditionally been very involved in humanitarian relief efforts domestically, as well as internationally. Domestically, there are four main types of military response that are available to each state. The first line of military response in most incidents is the National Guard, which is a reserve military force that is deployed by the state governor. This

form of state military response may provide timely response on a local level, to a community (FEMA NIMS courses, 2013). Another form of military response is through the aforementioned Mutual Aid Assistance Agreement, between emergency responders to provide assistance across boundaries. Immediate Response Authority (IRA) at the municipal, county or tribal level, in which a request for assistance may be issued from a civil authority, like the mayor, to deploy local military commanders to provide support to save lives and prevent human suffering (FEMA ESF, 2008) Lastly, federal military forces are activated upon the presidential disaster declaration under the Stafford Act, which provides an orderly means by which federal disaster assistance is granted to state and local governments (FEMA ESF, 2008)

The official role of the National Guard, which is located within each state, is to assist citizens with governor authorization for an organized response. When a disaster occurs, the state coordination officer pushes forward an executive order from the governor that authorizes the National Guard to respond. The systems used to coordinate internal operations are mainly either Emergency Management Constellation, or WebEOC® which bring real time crisis information management to the local, state and federal Emergency Operations Centers (DeLeon interview, 2014). EM Constellation is the official way in which counties request assistance from the state that was adopted by the state of Florida as an information management tool.

Private Sector

The private sector operates a large proportion of infrastructure domestically, and is essential in providing critical details for planning and decision-making during incidents (FEMA ESF, 2008). Through mutual aid networks, the private sector is able to support disaster relief in

sharing resources through establishing relationships prior to the occurrence of a disaster (FEMA NIMS courses, 2013). In seeking to make a contribution to disaster relief, most provide cash donations or inventory storage. Within the private sector, many companies have assumed one or more of the following roles: donor, collector or provider. Donors support through giving financial contributions, collectors gather finances from stakeholders such as customers, employees and suppliers to fund humanitarian relief operations, and providers offer goods and services (Cozzolino, 2012). For example, Johnson & Johnson stores artificial skin in their warehouse to assist humanitarian relief organizations. This offers an opportunity to pre-position emergency care items in order to assure preparedness once a disaster strikes. Another prime example of a provider would be Emergency Visions, a company that provides a cloud-based solution to clients such as the American Red Cross.

Discussion

Through analyzing the role of information flow and coordination of constituents involved in disaster relief, one can notice several coordination barriers that may arise. Such barriers that have been revealed in this section, in the field, as well as through research are: differences in organizational structure, technological expertise, management styles, knowledge and information sharing, and funding sources among each constituent (Hovhannessian, 2012).

Social Networks in Disaster Relief

Equipped with definitions of core terms essential in understanding social media in disaster relief, as well as gaining an overview of the role and coordination of each primary constituent involved in disaster relief, this section will further the analysis of social networks. The utilization of social media and emerging technology will be analyzed through the following categories that have been most commonly leveraged during disaster relief: Micro-blogs/Blogs, Social Networking sites, Content sharing sites, and Collaborative sites (Table 1) Through gaining a deeper understanding of how each of these networks was utilized in a disaster relief effort, one can deduct the potential in creating a strategy for constituents to implement in their supply chains.

Social Media and Emerging Technologies	Example
Micro-Blog/Blogs	Twitter, Blogs
Social Networking sites	Facebook
Content Sharing sites	YouTube
Collaborative sites	Wikipedia, CrisisCommons

Table 1: Social Media and Emerging Technology examples

(Base, 2012, Kaplan, 2010)

Micro-blogs:

At the forefront of micro-blogging websites, Twitter, a site launched in 2006, has distinguished itself as a short message service application that allows its users to broadcast messages with a limit of 140 characters (Lovejoy, 2012). Although 140 characters may not seem adequate in disseminating information, users continue to create innovative ways to leverage this form of communication. Twitter's mission, according to their website, is "to reach every person on the planet, defend users' free speech, and allow unfiltered information from some of the world's most distressed places."(Twitter website, 2014). The involvement of emergency managers involved in disaster response serves as a testament of Twitter's success in fulfilling this mission.

Research has revealed its ability to provide more timely information than even government officials and mainstream media, especially during a crisis or as an emergency is unfolding (Kavanaugh, 2012). Recognizing this advantage, "Twitter Alerts" provides an outlet to disseminate information in times of emergency to users. The use of Twitter hashtags allows data aggregation on a particular topic, which leads to more efficiency in retrieving information. This congregation of various data sources allows constituents, such as FEMA and the Red Cross, to gain access and listen to information exchanged among other constituents and the public. In addition to pushing information out to the public and other constituents, Twitter is also utilized to gain situational awareness. Constituents have noted that they use Twitter to decide whether to activate and deploy, given the commonalities in the sheer amount of re-tweets from users regarding a certain event. In the context of Hurricane Sandy, Twitter was the main venue for information sharing, with a record 1.1 million people mentioning the word "hurricane" within a 21-hour period (Base, 2012).

Blogs:

Once referred to as “we blogs,” blogs serve as online journals managed individually or by a community (Kaplan, 2010). Several publications have revealed that these blogs were created as a result of the rise of web feeds like RSS (Really Simple Syndication) (Kieffer, 2013). With this advancement in technology, RSS feeds allowed users to subscribe to various webpages, review updates, and receive timely updates on other devices. They have been referred to as the social media equivalent to personal webpages, which provide an outlet for the authors to interact with others (Kaplan, 2010). This outlet facilitates the generation and discussion of topics through granting users the freedom to express their thoughts (IBM Developer Works, 2009). The ways in which organizations leverage blogs vary widely, from providing simple updates to improving transparency throughout various operations.

In the disaster relief realm, several constituents utilize blogs in various ways. Most blogs are used in conjunction with other technologies, such as Facebook and Twitter, through hyperlinks. Sharing these links allows constituents to augment the information provided in a Facebook status, message or tweet. Many non-profits especially utilize these hyperlinks to link to external information.

Social Networking Sites:

These applications facilitate connection between users through creating virtual identities. This form of social media has made an astounding amount of information available that is leveraged by various actors to improve communication. Facebook, for example, has doubled in

users from 400 million in 2010 to about 845 million in 2012, earning the distinction of the most visited site on the Internet in the United States (Kavanaugh, 2012).

Emergency managers within disaster relief have leveraged these social networking sites to reach an unprecedented amount of users. They have been monitored over time in order to provide those involved in disaster relief with data regarding trends and patterns. Facebook alone supports several constituents such as local and state governments, as well as organizations such as the Information Systems for Crisis Response and Management (ISCRAM). The Facebook status messages facilitate sharing of a bit of information that is visible to other users' newsfeeds. The Facebook "walls" serve as means of communication to publicly message others, with media ranging from photos to videos. Emergency leaders have utilized their own Facebook sites to stay informed and gained real-time insight regarding an event (Kavanaugh, 2012). During Hurricane Sandy, "Sandy" became the number two most talked about topic on Facebook during 2012, another testament to its ubiquitous use.

Many organizations have realized the value of inputs from affected areas, as well as inputs from their extended social network to coordinate operations. According to a survey conducted by members of ISCRAM, emergency relief managers have acknowledged the efficacy of efficiently responding to disasters through identifying gaps in relief efforts by coordinating with other constituents (Tapia, 2013).

Content Sharing Sites:

This type of social media is leveraged to facilitate the sharing of content among users, ranging from videos through YouTube to pictures through Flickr and Instagram. Organizations

have utilized these content communities given their high popularity, with an estimated one hundred hours of video that are uploaded to YouTube every minute (YouTube Statistics, 2013). This type of medium has been leveraged by organizations to provide “contextual data,” in addition to other sources of information (Tapia, 2013). Both citizens and constituents are able to watch and post videos to glean disaster visuals (Base, 2012). This unique source of information, compared with traditional news media, allows constituents to gain unfiltered insight that could possibly aid in determining the magnitude of disasters through videos. During Hurricane Sandy, Instagram played a major role in sharing information, with an unprecedented ten storm-related pictures posted per second on the site (Base, 2012).

Collaborative Sites:

In order to improve efficiency and effectiveness and disaster response, constituents must utilize platforms to support group collaboration among citizens and organizations. One of the earliest examples of a web-based system that served as a platform for this coordination is Wikipedia, a “set of co-related pages on a particular subject that allows users to share content, replacing the complex document management systems” (IBM Developer Works, 2009). It has been leveraged given the unique feature of searchable pages, as well as the accessibility to edit and disseminate information that is necessary to make timely decisions (White, 2008). Types of Wikis vary by visibility and editing privileges, which limits the knowledge contained on wiki sites.

Another example of a collaborative site is CrisisCommons (Appendix B), which seeks to serve as a liaison in connecting current and future volunteer digital communities to organizational

structures. The Commons recognized the need to form relationships in advance of disasters, and therefore continually works with crisis response organizations in order to harness the interest and technical expertise of the crowd during emergencies. CrisisCommons exists as a virtual and physical forum to unite communities, as well as improve situational awareness for disaster response organizations. All forms of communication are archived on Wikipedia sites, which serves as a means of reflecting in order to continuously improve operations and processes. (CrisisCommons website, 2014).

Discussion

Technology has changed the ways in which responders operate in disaster relief. Initially, many responders desired to be the first in delivering critical information (Zielinski, 2013). Now, given the rapid transmission of information being shared by people around the world, these goals are simply unrealistic. Through analyzing the various forms of social media and emerging technologies, along with their application by various constituents, one can notice the emerging trend of collaboration and coordination among those involved.

Chapter 4

The Role of Social Networks in Disaster Relief Supply Chains

Research Methodology:

Research Question: Are there ways in which social media and emerging technologies can be used to improve the coordination of information in disaster response supply chains/logistics?

Criteria for Selection:

- Involved in domestic disaster response supply chains/logistics
- Some experience with social media personally/professionally

Interview Guide:

- Can you briefly describe your role in or experience with domestic disaster response?
- How are you using social media to improve disaster response supply chains/logistics?
- What benefits have you seen with social media in disaster response supply chains?
- What challenges have you encountered, or foresee, with social media utilized as a tool in disaster response in supply chains?
- Is that within your control to address?
- Mitigation?
- How do you envision social media being used in the future?
- Do you know anyone else working in this realm who may be helpful?

Stakeholder	Stakeholder	Interviewee
Academia, Research Institutions	ISCRAM: Information Systems for Crisis Response and Management	Robin Mays Researcher, PhD Student at University of Washington Rebecca Walton Researcher, Assistant professor of technical and professional communication at Utah State University Dr. Connie White CEO of Information Technology Solutions for Emergency Management Sahana Software Foundation designer Nuwan Waidyanatha Senior Research Fellow Early Warning Systems and Emergency Communication
Emergency Management Agencies	Federal Agencies: FEMA	Shayne Adamski Senior Manager of Digital Engagement Edward DeLissio FEMA Region III: Response Division, Logistics Branch Chief
	State	Bryan Koon Director of the Florida Division of Emergency Management
	Local	Elenka Jarolimek Seattle Emergency Management Coordinator of Resource Management and Logistics
Non-profit Organization	American Red Cross	Jill Bossi Chief Procurement Officer Charles Yopp Senior Director - Disaster and Chapter Sourcing, Procurement & Disaster Warehousing Sadia N. Lorentz Sr. Manager-Disaster Warehousing and Sourcing
	Center for Regional Disaster Resilience	Eric Holdeman Director, PNWER Center for Regional Disaster Resilience (CRDR)
	CrisisCommons	Pascal Schuback Director of CrisisCommons
Military	National Guard Army	Melissa Deleon National Guard Liaison
Private Sector	Service Providers	Timm Radar & Founder Shawn Smith SVP International Development Emergency Visions, Inc.

Table 2: Interview Selection

Chapter 5

Interview Analysis

While analyzing the interview responses regarding the role of social media and emerging technologies in disaster response logistics, the following three key themes emerged: Information to the right people, at the right place, at the right time; a critical tool in a toolbox to aid in decision making; as well as a need to shift the perception of these technologies. This section will further explore each theme within the lens of the SWOT Analysis Framework, in order to highlight the uses by various constituents, strengths, weaknesses, opportunities and threats.

Theme 1: Information to the right people, at the right place, at the right time:

Social media and emerging technologies have been leveraged to expedite the flow of information among constituents. In illustrating the use of these technologies to get information to the right people, FEMA leverages social network accounts for ‘multiple stakeholders, multiple customers that can cover multiple topics’ (Adamski, 2014). The Senior of Digital Engagement noted that it is not only used to write and craft a message for a particular audience. The Director of Crisis Commons agreed that “data information from these technologies are not only for one person to make one decision, it is to be used in multiple ways for multiple people to make decisions in their respective worlds (Schuback, 2014). An example he demonstrated was in the case of a fire, one tweet pushed through a social media channel like Twitter may be used to make the following decisions: closing a store for the day for a small business owner, and alert logistics providers to avoid affected routes for more effective and safer transportation. A huge benefit of

social media is the accessibility for different users (Appendix A). For example, FEMA accounts can be accessed through the website (fema.gov), a smartphone application, and a texting service through the disaster recovery center. The Emergency Manager for the city of Seattle noted that “Yammer!,” which is similar to Facebook, is the social media tool utilized to push timely information, studies and after-action reports to a network of people (Jarolimek, 2014).

FEMA’s Social Hub serves as a platform to integrate various social media conversations (Appendix A). Topics featured may include weather conditions with varying levels of severity, as well as timely disaster response updates (FEMA Social Hub website, 2014). According to Adamski, this platform serves as a method in which FEMA is able to amplify and promote efforts. Currently, the Social Hub only pulls information from Twitter accounts, which is the tool that the majority of state emergency management constituents are using. However, although the Social Hub offers additional channels to communicate with people, social networking in general shouldn’t be used at the expense of other outreach efforts. Adamski stated “It can’t be the only point of distribution; FEMA must replicate these communications in other mediums as well” (Adamski, 2014).

In emphasizing this point, Koon noted the demographic limitations within certain states. Florida obviously has a large retired and poor population who are less inclined to use social media. However, he claims, it should not be viewed as a barrier, only as simply a limitation (Koon, 2014). It is unrealistic to assume that the Florida Division of Emergency Management can push one magic button to get everyone the information they need; but as long as a variety of options are available, then we can meet the needs of citizens (Koon, 2014).

Strengths:

Pascal Schuback, the Co-Chair Governance of CrisisCommons, noted that these technologies are integral in matching supply and demand with other organizations. Information that some people deem not necessary is actually critical, since various constituents may view the same message differently. Social media is helpful for gaining situational awareness that provides details that might mitigate the risk of transportation errors (Schuback, 2014). The Chief Procurement Officer of the Red Cross also concurred that these tools “allow responders to streamline the process from disaster to delivery (Appendix A), in using a more timely response to locate victims in affected communities” (Bossi, 2014). The details extracted from social networks are also used by FEMA in determining the ideal timing to transition from disaster to non-disaster content, such as monitoring the number of people who are sharing information and trends in conversations about various events on social networks. (Adamski, 2014)

Another main benefit of these technologies is the force multiplier capability, which is the power of “someone receiving information and sharing it with their network” (Appendix A). This unique benefit also reduces the need for FEMA to have an active presence on every social tool, since other constituents may share similar information with their own network (Adamski, 2014). For example, if something is posted on Facebook, the media may repost it on the evening news” (Koon, 2014). A Board Director of the Sahana Software Foundation concurred that rather than leveraging one medium of communication, responders are able to push one message out through multiple integrated technologies. “Through multi-agency situational awareness, many organizations have integrated technologies through a common platform. For example, a local authority issuing flood warnings may issue an alert that the area is inundated. This information is

essential to a diverse range of agencies in making decisions such as rerouting an ambulance route that has been affected” (Waidyanatha, 2014).

The dark side of this force multiplier capability is the amplified potential for miscommunication and misinterpretation of information (Appendix A). The spread of rumors is a challenge that many responders face, especially during Hurricane Sandy in 2012. In response, FEMA set up rumor control to mitigate the excess time and resources that were spent monitoring rumors. However, given the inevitable nature of rumors, Adamski notes that this is a common trait among various disasters via all methods of communication. ”There will always be rumors with any emergency, think about false 911 calls. It is nothing new, it is just a new medium” (Adamski, 2014). In analyzing the impact of these rumors, he offers a great perspective and defines qualifying factors in deciding how to mitigate and address miscommunication. “It is important to look at what the rumor actually is, how many people are talking about it and spreading it, are people being confused about it, and then deciding which ones to tackle and correct. For example, it is okay if people disagree with us, but rumors blatantly contradicting FEMA’s roles and responsibilities need to be addressed” (Adamski, 2014). In mitigating these rumors, FEMA has viewed rumors as discussion points, and refuses to delete any posts from social networking sites. Thus, this challenge provides an opportunity for social media to be leveraged as a tool to mitigate the spread of rumors. Likewise, the Florida Division of Emergency Management has taken a similar stance. “We are able to dispel myths and rumors much more quickly than we ever have using social media” (Koon, 2014).

Opportunity:

These technologies have been recognized to have the unprecedented potential of improving visibility (Appendix A). For example, within the Red Cross, inventory is received by

either the organization-owned warehouse, or in-kind donations. In recent years, there has been more pressure on organizations to improve visibility in the utilization of in-kind donations. Social networks have the potential to serve as a viable tool in connecting the Red Cross with in-kind donors to communicate timely information regarding the movement of funds and resources, thus serving as an accountability measure (Lorentz, 2014).

From a sourcing perspective, an opportunity in leveraging these technologies is to gain information and improve visibility is to track information associated with procuring a service or resource through social networks, such as Twitter. The Emergency Manager for the city of Seattle noted, “The ability to track the movement of where commodities are going would be an excellent use of social media. These technologies would be most useful in disseminating information about where the commodities are available in the point of use, or staging areas” (Jarolimek, 2014).

However, it is essential to consider the risks of using these technologies in this way. The challenge with this open movement coordination is that it must be controlled to avoid the risk of theft. Jarolimek noted the potential of danger to pushing out too much information, which could be a hindrance to the ability to prioritize and be able to move resources from point A to point B. Within Hurricane Katrina, theft was augmented since a subculture of people profited through selling resources on the black market. (Jarolimek, 2014)

Threats:

One of the main challenges that were noted by representatives within government emergency agencies, such as FEMA and the Florida Division of Emergency Management, was government resistance (Appendix A). Koon claimed that the government in general is slow to implement technologies, due to issues such as lack of resources. Therefore, it is tough to keep up

with new technologies and figure out how to make them useful while complying with governmental regulations (Koon, 2014). For example, within the state of Florida, initially, it was tough to push out messaging through Facebook or Twitter because counties lacked a social media policy in place. Now, little progress has been made, with some counties in Florida even banning responses to posts on social networks due to strict open record retention policies (Koon, 2014).

Further restrictions that exist in pushing information out to various audiences are the consistency in messages to control the brand. For instance, a National Guard Liaison Officer noted that the main challenge in utilizing social media is formal structure of communication, in which the National Guard in each state must collaborate with the Joint Information Centers (JIC) to ensure unified efforts. “Messages may only be disseminated to the public after consolidation occurs within a JIC to coordinate messaging and operations” (DeLeon, 2014). Therefore, organizations with this formal hierarchy must balance the freedom of people to use these technologies creatively, while maintaining a level of oversight of the brand and content of the message (Koon, 2014).

In conclusion, although these tools have been typically leveraged to disseminate information to stakeholders, the value exceeds this capability. Another advantage is the bidirectional communication, as noted by Bryan Koon, the Director of the Florida Division of Emergency Management. “Social media is being used in two ways. One way is to push out information through all media channels in order to inform people about situations and influence actions that they’re taking, such as evacuation and preparedness. The other way it is being used is pulling information to help drive disaster response. The monitoring and use of social media outlets allows the division to ascertain what is going on” (Koon, 2014). Similarly, the Director of the Center for Disaster Resilience concurred, “Nature of the work is changing. Social media

channels must be used to both push information out, as well as monitor and use social media as input in decision-making (Holdeman, 2014). This leads into the next tool, utilizing these technologies as a tool in a toolbox.

Theme 2: Critical Tool in the Toolbox

Many representatives emphasized the use of these technologies as means of receiving information. In illustrating this theme, within FEMA, Adamski stated “FEMA uses digital and social tools as just another tool in the toolkit. It doesn’t solve anything alone; it is one of our many tools to spread our message through different channels” (Adamski, 2014). Through leveraging these technologies as input, a diverse range of data can be extracted from social networks. Through leveraging social media as an input in disaster response, the Florida Division of Emergency Management (DEM) is able to understand the content of social media for situational awareness, as well as gain trends related to the frequency and location of the information received (Koon, 2014). By using this information, the DEM is able to better allocate the resources necessary during an emergency. For example, Koon noted that these technologies could even be used to make decisions regarding where the damage assessment team should locate on the field.

Strength:

Information gathered from social networks can be received from a variety of sources. Koon emphasized the value of social media in shifting the role of individuals from mere bystanders, to responders. “It can help create ad hoc groups, which naturally happened within communities but will happen much more quickly through these technologies. It can be used to

cross-connect people with a need to people who can match that need” (Koon, 2014). The term that best describes this trend is “crowdsourcing,” which was coined in 2006 by Jeff Howe. The official meaning is “the act of taking a job traditionally performed by a designated agent and outsourcing it to an undefined group of people in an open call” (Howe, 2006).

As interpreted by responders, crowdsourcing is a means of matching needs on ground through citizen involvement. Its capabilities far exceed the original purpose, as it is now being used to integrate various technologies such as mapping, which may connect to a text message with more information, which can be pushed out to Twitter, which can be integrated with blogs or pictures through Flickr (Jarolimek, 2014). Koon depicts his experiences as the Former Director of Emergency Management for Wal-Mart, “Initially, it would take a while to gain insight into the situation on the ground because of a lack of connectivity. The only option was to send people to affected areas to collect data. However, social media has allowed an instantaneous method of gaining situational awareness through uploading media, through sites like Google Crisis Maps. People are now populating this data for us, which allows us to act on it much more quickly than before” (Koon, 2014).

Weakness:

Two broad challenges accompany this ample amount of access to informal data sources is the overwhelming amount of data available, as well as validation of these external sources (Appendix A). First, the additional time and resources that exceed capacity of organizations to monitor social media and technologies was cited as an internal challenge among many organizations. Likewise, within the National Guard, “getting access [to information] isn’t the problem, the issue is sifting through it and figuring out what is important” (DeLeon, 2014). In addressing this issue, Holdeman claims that the true issue is a lack of will, in which a cultural

change needs to occur. Workshops, according to Holdeman, are not an effective means of addressing this concern. Due to the widening gap between the public and responders in the use of social media and emerging technologies, organizations need to understand the importance and benefits of these tools.

In addition to the massive amounts of data, another challenge in leveraging these technologies as a source of information is the reliability of unofficial sources (Appendix A). DeLeon depicts the latter concern within National Guard, “Our system is set up so we have validated information, and requests can only come from counties. We have an official system that we work through to support information and response to have validated information” (DeLeon, 2014). Currently, the National Guard operates using a closed-system, in that the on-the-ground information is only validated by an internal source, which may be communicated through technologies such as smartphones to provide greater situational awareness. Similarly, a designer for the Sahana Foundation concurred that “Social media is just information; it must be categorized and sent to the right person so that a decision may be made. Sahana Foundation utilizes a model in which the information may be taken in through official modes or non-official modes, to be validated” (White, 2014).

Opportunity:

In response to this concern, Holdeman notes that data through these technologies shouldn't be used as confirmed data, but it allows responders to start leaning in that direction and dedicating resources towards validating that data. For example, if fifty distinct tweets are posted on Twitter about a particular threat, compared to one tweet, then the likelihood of that event being true is higher. Responders assume that the public will deliberately try to mislead and spread false information (Holdeman, 2014). These technologies should be monitored to extrapolate

information. One of the beauties of crowdsourcing is that the public has the potential to correct any erroneous messages. Likewise, Schuback concurs that responders are able to use deductive reasoning to make decisions through crowdsourcing (Appendix A). “Responders need to perceive the public as on the ground sources of information, as opposed to unverifiable sources” (Schuback, 2014). White alluded to this concern that is shared among several organizations, a lack of trust in the public (White, 2014). However, Waidyanatha noted a unique interpretation of this reality. “Through allowing the public to have an active role in monitoring and providing insight in response to user comments, the burden is shifted away from the authorities to having to cater to individual needs. The public will take care of it on their own” (Waidyanatha, 2014). This shift in perception of the value of social networks is the core of the following theme.

Theme 3: Shift in the perception of Social Networks

“Social media is another tool in the toolbox, but it is also a tool expanding the toolbox” (Schuback, 2014). In further explanation, Schuback noted how the shift from a corded home telephone to mobile handheld device is similar to social media, in that they both actually expand the toolbox. “The same message is being communicated, but the only change is the medium in which it is received” (Schuback, 2014). These quotes perfectly articulate the shift in the value of social media and emerging technologies that many responders alluded to.

Strengths:

A point that was expressed by several constituents is that these tools are simply a shift in technology that will change how emergency management organizations function. However, this is contrary to common assumptions, as Holdeman alluded. “People think that social media is

something new that needs new resources. It isn't that, it is that people need different skills to utilize it" (Holdeman, 2014). An analogy was used to contrast the ways in which work was conducted decades ago with social media today, "social media can be leveraged as a tool to do things in different ways that they have been done previously. For example, in addition to watching television, many responders are monitoring online sources to gain insight on disasters." (Holdeman, 2014).

Weakness:

An internal weakness that was commonly expressed among several constituents was the learning curve associated with these technologies (Appendix A). There is a generation of people that generally do not gravitate towards that method of communication (Lorentz, 2014). The idea of collaboration on a system is hard for people to grasp given that the comfort zone of certain generations still resides in email, which is not as dynamic as these new technologies. Likewise, CrisisCommons began an initiative called "CrisisCampers" that involved volunteers traveling throughout the country to teach responders how open technologies can be integrated with other sites. One of the main challenges is an overall resistance to change. The root of this resistance to an open source technology, as Schuback stated, is that people generally desire to control the flow and access of information.

In addressing this challenge, two strong points were proposed by respondents. The Emergency Manager for the city of Seattle stressed the importance of showing people, who would otherwise be resistant to the technology, its benefits. Through training responders in several organizations on how to monitor social media to improve processes, Schuback has expectedly encountered resistance from emergency management professionals. He cites "educating people to understand that technology can help them, and will not always reduce them"

as a source of resistance. Technology like social media and emerging technology helps people do their jobs better, therefore increasing the productivity of responders” (Schuback, 2014).

Also, incorporating these technologies into daily processes will allow people to feel more comfortable. In a chaotic environment, people will gravitate towards what they are most comfortable with, so if they haven’t used a social media tool before, they probably won’t use it during a disaster response situation. (Jarolimek, 2014) However, in incorporating these tools, Bossi notes that it is important for organizations to understand the need to change its processes, instead of viewing technology as a customizing tool. “Responders must become comfortable with the tool itself, instead of changing the tool” (Bossi, 2014). Holdeman takes this point a step further in stating that these emerging technologies will naturally become embedded in disaster realm processes due to the generational shift occurring as the baby boomers begin to retire (Holdeman, 2014). Representatives from the Red Cross concurred that although this challenge is prevalent throughout several organizations, as the technologically savvy younger generation increasingly assumes roles as responders, an opportunity exists to embed these emerging technologies into current processes. (Red Cross, 2014)

Opportunity:

Social media will continue to evolve as new technologies are globalized and shared, and continue to be perfected. Many constituents agree that it is essential to monitor the emergence of these tools. Adamski noted “FEMA is always keeping an ear to the ground to see what social tools and mobile applications that makes sense for us to have a presence on, to be able to share information and have a conversation with stakeholders” (Adamski, 2014). Likewise, the Florida DEM provided an example of a potential development of a technology to leverage emerging capabilities. He used the analogy of changing the current alerting system of painting with a roller

brush to disseminate information, to potentially painting with a fine brush to more accurately tailor messages to certain people through leveraging emerging technologies. “Currently, there are limitations in forecasting accuracy and geo-spatial location. However, in the future, as technology evolves with the proliferation of smartphones and the ability to tailor messages to people based on their exact location will lead to more detailed alert systems. This hyper-specific storm surge notification in communicating with the public is called Project Pilot” (Koon, 2014).

Threat:

Although many challenges lie within organizations, an external challenge associated with the speed at which technology is emerging is that “when responders penetrate one technology, another will emerge given the technological trend (Appendix A). It is hard to foresee the trends of new technology that may emerge and outdate existing technologies” (White, 2014). Given this trend, many researchers and practitioners agreed that an appointed position might be necessary in monitoring any applicable social media trends. “Although this may exceed the capacity of organizations, many organizations should have a Public Information Officer whose responsibility is to understand what the public needs to know and to monitor these technologies to maintain relevancy (Mays, White, Jarolimek, 2014). Koon expressed the importance of this role given the dependent relationship of social networks and emerging technology. He claimed, “These technologies have the power to render you [constituents] obsolete, and must be used in order to avoid becoming irrelevant. In essence, the integration of these technologies in emergency management operations is inevitable” (Koon, 2014).

Chapter 6

Concluding Remarks

Limitations in Research

Throughout the process of conducting research in this realm, a flexible approach was essential given two limitations. First, the speed at which social media and emerging technologies evolved. It seemed as though by the time one chapter was complete, a new technology emerged that prompted the revision of a previous chapter. Therefore, it was crucial to constantly monitor any new technologies in order to discuss them in this paper, as applicable.

Initially, this research was originally aimed at harnessing the value of social media and emerging technologies within disaster response logistics through understanding information flows. However, one of the challenges encountered with this approach was the fact that information flows vary depending on the type and severity of disasters, as well as the hierarchal structure. For instance, some organizations with an informal hierarchy may receive information in a manner that has not been adapted in agencies with a formal hierarchy, such as crowdsourcing. Another challenge that was revealed through interviewing representatives was the wide-ranging adoption of these emerging technologies. Deeper analysis of interview responses revealed that most technologies were leveraged to enhance internal collaboration. Given these findings, the research question was altered to address the “why” inquiry that many constituents shared in approaching these technologies.

Conclusion

This research gleans a positive outlook on the potential of social media and emerging technologies within disaster response through revealing a myriad of benefits and opportunities that may be derived. Research included in the literature review, as well as the pertinent insight provided by those who are experts in the fields of disaster supply chains and emerging technologies, have revealed the value of using these tools as a tool in the toolbox, as well as a means of dissemination information to the right people, at the right place, at the right time.

Several challenges that are inherent in disaster relief supply chains may be addressed by using these technologies. In streamlining the processes from disaster to delivery, organizations can gain visibility into demand requirements through monitoring these tools for input from the public as well as other constituents. In addition, many responders in charge of geographical regions have blind spots. These technologies provide an opportunity to extrapolate data from various sources to triangulate information. Interview respondents also contributed valuable methods of mitigating the challenges associated with leveraging these tools. Perhaps the most important mitigation strategy is to shift the perception of these technologies, which will predicate the ability of organizations to begin implementation. Organizations must recognize that this is simply a change in the medium of communications, with the potential to reach a broader audience. In conclusion, as technologies continue to emerge, and responders involved in disaster relief collaborate and discuss the value of social networks in this realm, one will begin to witness a transformation in the adoption of these technologies in disaster relief supply chains.

Appendix A

Framework for Social Networks in Disaster Relief Supply Chains/Logistics

<p>Strength:</p> <ul style="list-style-type: none"> • Real-time decision support • Accessibility • Bidirectional communication • Resource visibility • Streamline disaster to delivery • Force-multiplier • Multiagency situational awareness • Trend analysis • Accountability measure • Integrate with other technologies • Deductive reasoning for validation 	<p>Opportunity:</p> <ul style="list-style-type: none"> • Crowdsourcing • Embedded in processes • Inventory visibility • Generational shift • Respond to victim needs • Technology to analyze big data • FEMA Social Hub • Response Vision 4.0
<p>Weakness:</p> <ul style="list-style-type: none"> • Resistance to change • Learning curve • Big data • Lack of resources • Lack of trust and accountability measures • Privacy 	<p>Threat:</p> <ul style="list-style-type: none"> • Infrastructure damage • Introduction of new technologies that outdate existing • Spread of misinformation • Overload of data usage • Government resistance

Appendix B

Biography of Interview Respondents

Academia:

Robin Mays is a first-year Ph.D. Student in the Department of Human Centered Design & Engineering at University of Washington. Her research is aimed at “uncovering the hidden work of humanitarian response operations and promoting understanding of key decision-making and information critical for effective response. Through her research, Mays hopes to reveal critical elements for integrating logistics planning into humanitarian programming at local levels with supporting action at the international level—allowing more appropriate response and resource availability at time of disaster; as well as providing ways to evaluate the impact of new technologies for humanitarian logistics that reflect the values of the development community, protect the rights of people, and empower NGOs to minimize destructive effects of inappropriate technologies being forced into their work” (University of Washington, 2012).

Rebecca Walton is a tenure-track, assistant professor in the Department of English at Utah State University. She teaches courses in document design, information and communication technology, and technical communication. Her research explores how human and contextual factors affect the design and use of information and communication technologies in resource-constrained environments. Her work has appeared in journals such as *Technical Communication*

Quarterly, IEEE Transactions on Professional Communication, and Information Technologies and International Development. (LinkedIn, 2014).

Dr. Connie White is the founder and director of Information Technology Solutions for Emergency Management. She is one of the frontiers of the social media movement identifying and teaching state of the art concepts that keep the information new. Dr. White is considered an international expert and has published on the topic of Social Media in many journals, books and conference proceedings including the IAEM Bulletin, Journal of Emergency Management and the International Journal for Information Systems for Crisis Response and Management. The Department of Homeland Security, S&T invited Dr. White as one of the initial teams of people to explore the possibilities of implementing social media at Ogma. She presently advises numerous county level emergency management agencies and is an invited instructor to many practitioner conferences (ITSFEM website, 2014). She is also a Designer for the Sahana Software Foundation.

Nuwan Waidyanatha is a researcher who is Board Director and Chair Standards/Interoperability for the Sahana Software Foundation. His research is focused on the common alerting protocol that is a standardized approach to alerting citizens with consistent and comprehensive messages regarding response actions that should be taken after emergency threats. These standards are active during the pre-disaster and post-disaster phase, which includes alert responders to active emergency response plans. This technology is designed for all-media, in which single entries of messages can be disseminated through various media channels simultaneously, as well as all-hazards, for all types of hazards.

Government Agencies:

Federal:

Shayne Adamski is the Senior Manager of Digital Engagement of FEMA. His responsibilities include overseeing public affairs that include web, social and mobile tools. Regarding social media use within FEMA, Adamski noted that it is used as a “communication mechanism and as a method to listen to stakeholders for the mission area, which includes the different phases of emergency management.”

Edward DeLissio is the Logistics Branch Chief of FEMA Region III: Response Division. In this role, DeLissio plans, manages, and sustains regional logistics response and recovery operations in support of domestic emergencies and special events while serving as the single logistics integrator for incident support in Region III. The Branch synchronizes logistics plans, operations, distribution and resource management in support of all field operations in conjunction with FEMA’s Logistics Management Directorate as well as federal and state partners. (FEMA website, 2014)

State:

Bryan Koon is Director of the Florida Division of Emergency Management, and is responsible for the response, recovery and mitigation against natural and man made disasters in Florida. His role includes coordinating with various stakeholders across the local, state and federal levels. He was also the Former Director of Emergency Management of Wal-Mart.

Local:

Elenka Jarolimek is the Seattle Emergency Management Coordinator, responsible for the coordination of the logistics, personnel, fleet coordination. Her main role includes planning under ESF 7: Resource Management and Logistics. Systems used to coordinate information are Sharepoint, as well as Web EOC to request resources.

Non-Profit Organizations

Eric Holdeman currently serves on the Advisory Council for the Center for Regional Disaster Resilience and the Pacific Northwest-Advanced National Seismic Safety Region Advisory Committee. Holdeman is considered an expert in the realm of emergency management and homeland security. His areas of expertise include “building regional coalitions between agencies, governments, the private sector and non-profits. Planning, Regional planning, Emergency Operations Center (EOC) design and construction, multi-media public education programs, Joint Information Center (JIC) formation and operations, media relations, social media, meeting facilitation and integration of technology into emergency management and homeland security programs are just a few of the areas in which he has extensive experience. In 2007, he was recognized by Government Technology Magazine as one of the Top 25 people in the nation who "challenges convention, confronts entrenched bureaucracy and promotes innovation" (Eric Holdeman website, 2014). Eric was the past President of the Washington State Emergency Management Association (WSEMA).

Pascal Schuback is an Emergency Manager, who has assumed the role of the Core Member & Co-Chair Governance of CrisisCommons, which is a global network of volunteers using open technology to help people in crisis. Schuback’s experience ranges from county, city, state and federal experience in disaster response within the United States. Crisis Commons is

focused on integrating technology in disaster response in order to connect people and technology together. The goal is to “help people understand and use technology better” (Schuback, 2014).

As the Chief Procurement Officer of the Red Cross, Jill Bossi is responsible for providing strategic leadership and direction in all areas of strategic sourcing, procurement, contracting, real estate and travel management for The American National Red Cross in all fifty states and its territories around the world. Other supply Chain professionals who were interviewed include Sadia N. Lorentz, CPSM, C.P.M, the Senior Manager of Disaster Warehousing and Sourcing, as well as Charles Yopp, the Senior Director of Supply Chain Management.

Private Sector

Shawn Smith, the Founder of Emergency Visions, as well as Timm Radar, the Senior Vice President of International Development, were interviewed. Radar’s expertise lies in logistics as well as supply chain. Smith is an industry expert in crisis communications. Emergency Visions (EV) is a prime example of a company that has fully embraced the power of social networks in disaster response. Emergency Visions is an organization that was founded in 2002 to provide various constituents with a cloud-based solution to address each phase of disasters. (Emergency Visions website, 2014). Clients who are serviced are State Emergency Response Team, the American Red Cross, the Medical Academic and Scientific Community Organization (MASCO), as well as the WorldVision organization. The company’s goal is to improve the coordination of both people and resources in ordinary circumstances, to understand how to leverage the tools offered during an emergency.

Military:

Melissa Deleon is the National Guard Liaison Officer who is responsible for making sure that the Florida National Guard is integrated with the Florida Division of Emergency Management. The system leveraged to coordinate information is Emergency Management Consolation (EM Constellation), which includes situational awareness, press releases, and documentation of information.

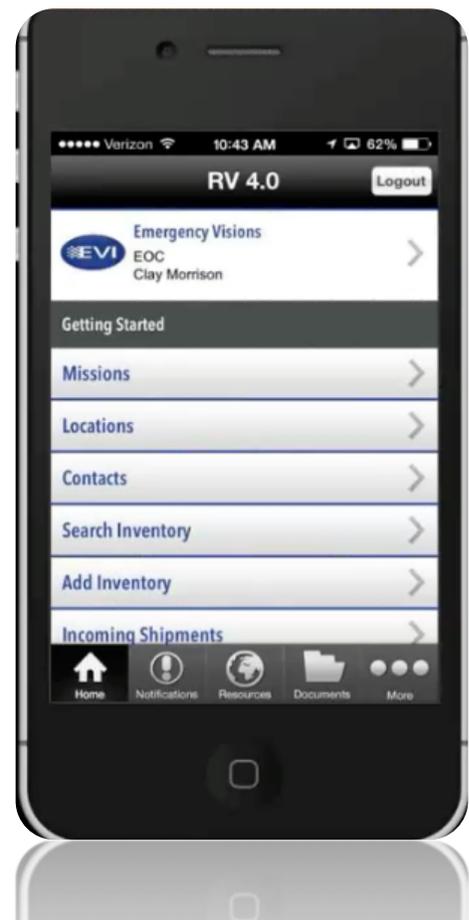
Appendix C

Emerging Technologies

Appendix C provides a visual understanding of some of the social media applications and emerging technologies mentioned throughout the thesis. The following images are screenshots, as well as brief descriptions.

Response Vision 4.0

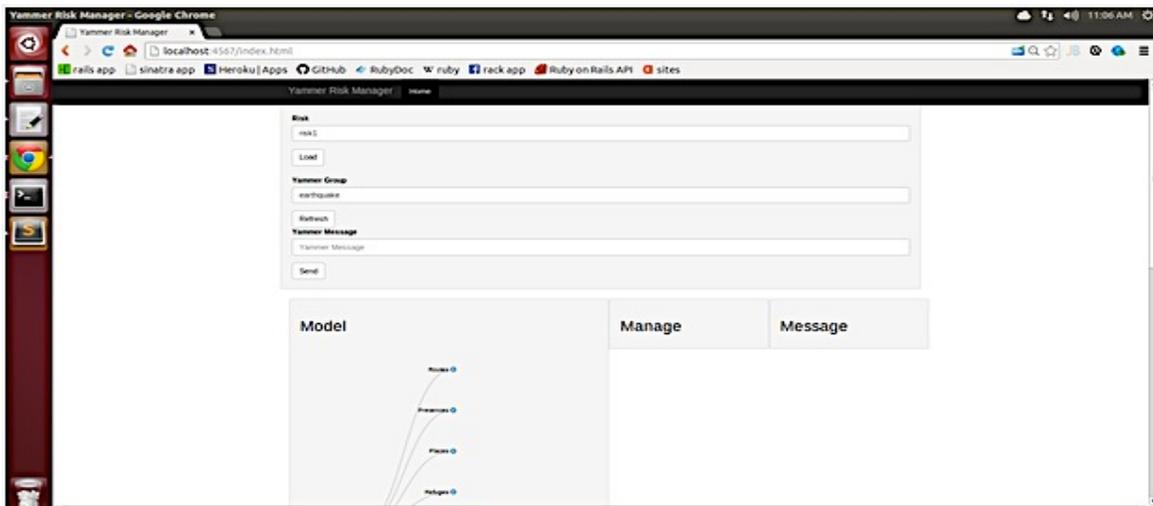
Emergency Visions offers software called Response Vision 4.0 to responders, which aims to tailor the cloud-based technology towards various responders. This technology provides social mapping through geospatial data in order to monitor inventory levels and the location of emergency hubs (Radar, 2014). The Response Vision 4.0 has emerged from a web-based technology to a mobile application in order to adapt to the technological trends. This app provides visibility into emergency needs, such as shelters, hospitals, and various resources. In order to ensure coordination with various responders, a resource networks are available, enabling ‘operational visibility’ (Radar, 2014) by allowing users to share inventory levels and resource information with other responders. The founder of Emergency Visions claims



“social networking sites are allies in emergency response, and applies to all four phases of emergencies.”

Yammer

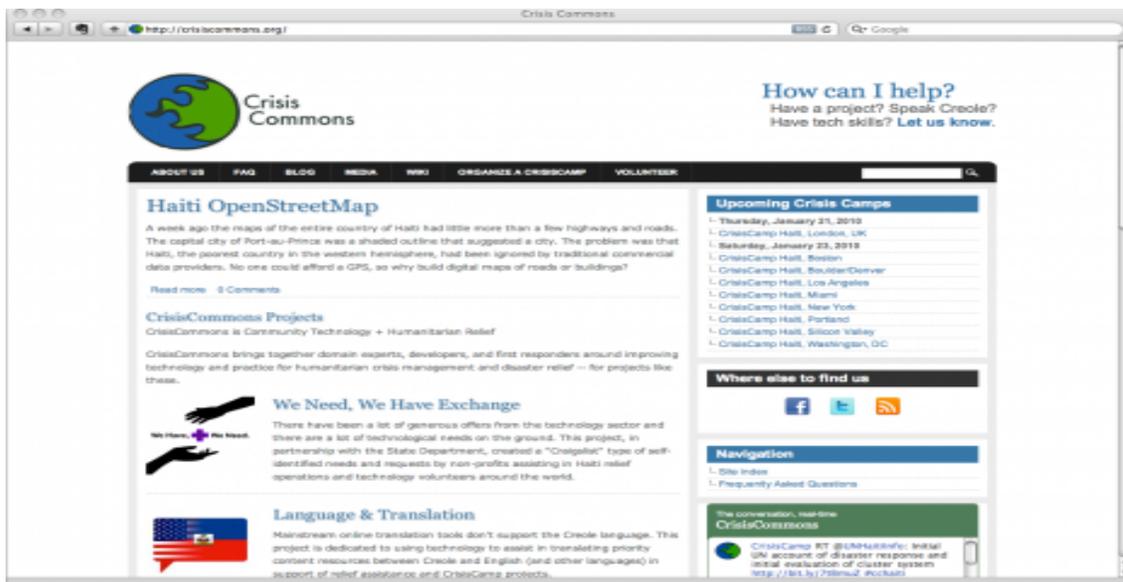
Microsoft bought the enterprise social company Yammer to serve as a social integration tool within enterprises and organizations. Similar to the SharePoint, the goal of Yammer is to ensure a seamless integration across all Microsoft products for users. Yammer Emergency Management is “an online application that provides real-time graphical modeling system to help emergency managers communicate and collaborate to manage an emergency response. This system combines modeling, management, and messaging (Yammer website, 2013). Constituents such as Seattle Emergency Management are utilizing this app.



CrisisCommons

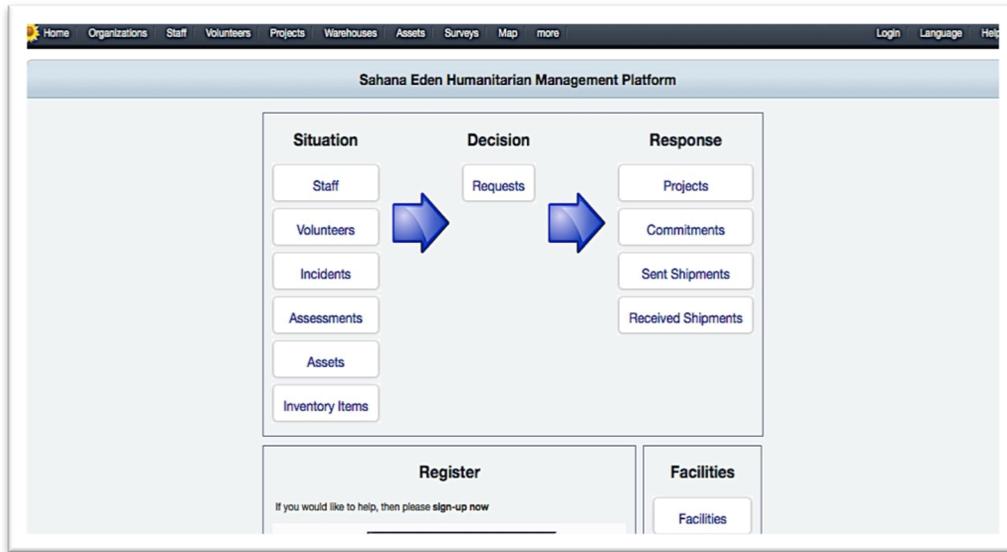
CrisisCommons evolved in order to address the need for greater capacity of resources to coordinate with disaster response organizations on a long-term basis to improve (CrisisCommons

website, 2014). Ultimately, CrisisCommons seeks to provide a virtual and physical forum to bring together communities, advance innovation in (both technology and business processes) to create capability, capacity and and greater situational awareness for crisis response organizations, diasporas and informal networks who seek to aid people in crisis.



Sahana Software Foundation

The mission of Sahana Software Foundation is to help alleviate human suffering by providing emergency managers, disaster response professionals and communities with information needed in both the preparation and response phase of emergency management through to developing free and open source software (Sahana website, 2014). Built specifically for Disaster Management, Sahana Eden provides the following wide range of functions: Organization Registry, Project Tracking, Human Resources, Inventory, Asset management, Organizational Assessments, Shelter management through gaining location information, scenario and event planning, fully integrated mapping, as well as messaging.



(Sahana Software Eden demo, 2014)

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Supply Chain INROADS Intern- Global Procurement Organization

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- Participated in LTA Negotiations with global suppliers, resulting in cost reduction opportunity of \$1 million
- Created Supplier Repair Capability Database to maximize LTA Spend, resulting in \$200,000 yearly savings opportunity

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- Managed 20 outside vendors through daily production meetings, communication with vendors, and updating SAP
- Designed and implemented a visual gating solution for disk replacements to enhance communication through cross functional

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- Collaborated with IT to design a system that displays and manages active freight movement to eliminate waste, resulting in an 80% reduction in inquiries received by the Shipping/Receiving Dpt.
- Implemented a more ergonomically correct kitting strategy through Kaizen Event for manufacturing, resulting in a 5 hour time savings reduction

LEADERSHIP:

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President

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