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Alternate 1: Information and Knowledge Exploration

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Information Sharing in Emergency Response

Abstract

Groups are typically assembled to respond to extreme events or emergencies, such as might be precipitated by natural or man-made disasters. These events are characterized by complexities and dynamism (Skertchly & Skertchly, 2001; Weick, 1993, 1995) that require group members to share and utilize their unique knowledge and expertise in order to better control and manage them. Prior studies that have investigated information sharing and use in groups however, report that groups tend not to share their unique information, leading to poor decisions. This phenomenon is called biased information sharing. For example, in the recent Haiti earthquake, accounts were documented about resources that were mismanaged and distributed inefficiently as a result of poor communication among relief agencies on ground. Although these agencies show cooperative tendencies by exchanging daily updates of activities, important information that is needed to better route resources were not communicated adequately. This suggests that information sharing and use may be influenced by the importance of information itself, leading to better decisions made in a group setting. This paper reports on study-in-progress that investigates information sharing strategies at a managerial level by analyzing after-action reports of the earthquake in Haiti.

Keywords: group decision making, information sharing, emergency management, collaboration

1. Introduction

Extreme events or emergencies, such as might be precipitated by natural or man-made disasters, are characterized by complexities and dynamism (Skertchly & Skertchly, 2001; Weick, 1993, 1995). Managing such emergencies creates the need for collaboration of personnel across diverse fields in the form of groups of responders to manage the situation. As part of their work, response personnel seek and handle information about the emergency from a range of sources as the situation unfolds in order to create situational awareness for other stakeholders (Ozel, 2001; Weick, 1993). Response personnel are also required to share and utilize their unique knowledge and expertise in order to better control and manage response efforts.

Information sharing and use have been studied in several domains such as the web (e.g., Pirolli, 2007; Zhang, Jansen & Spink, 2009), military command and control (e.g., Sonnenwald & Pierce, 2000), as well as through technologies supporting collaborative information sharing during catastrophic events (Turoff, Chumer, Walle & Yao, 2003). Studies that explore the role of collaboration on response efforts report that there is a need for an understanding of the environmental factors that shape the information sharing behavior (e.g., Hansen & Kalervo, 2005), including time constraint, group size, decision quality, role of members in the group, and event severity (Foster, 2004; Reddy & Jansen, 2008; Weick, 1993).

With regards to the need for effective information sharing, these studies report that groups tend not to share information known to each group member, leading to poor

decisions. This phenomenon is called biased information sharing (Stasser, Taylor & Hanna, 1989; Stasser & Titus, 1987). Biased information sharing is defined as the act of sharing information that is already known to all group members rather than sharing unique information known to group members that might not be known by some or all of the other group members (Stasser, Taylor & Hanna, 1989; Stasser & Titus, 1987). For example, in the recent Haiti earthquake, accounts were documented about resources that were mismanaged and distributed inefficiently as a result of poor communication among relief agencies on ground. Although these agencies show cooperative tendencies by publicizing daily updates of activities, information believed to be important and that is needed to better route resources were not communicated adequately. This information communication behavior noticed might be attributed to the fact that agencies preferred not to share information because it was not seen as important or just neglected because each agency thought that the information is already available to others. A recent study (Steinel, Utz & Koning, 2010) explains the deceptive notion of creating a cooperative initiative shown by response agencies as a strategy to accrue social status during response efforts.

Information influence theory (Shaw, 1981) holds that the importance of information may affect how information is processed for making decisions in groups. Information value in this paper is referred to as its utility toward goal attainment. This theory therefore suggests that information sharing and use may be influenced by the importance of information itself, leading to better decisions made in a group setting. We argue however that the strategy employed in exchanging information during group work may influence team performance as a function of decision-making. The objective of this study is to identify key issues that response teams in Haiti came across and how information about such issues was shared in order for stakeholders to make informed and effective decisions during response operations. Data for this study is retrieved from daily situation reports communicated by The United Nations Office for the Coordination of Humanitarian Affairs.

The paper proceeds as follows: A brief description of information sharing and emergency management and response domain (Section 2). The methodology of the study is then described in Section 3. Finally, the conclusion of the paper discusses contributions of this research as well as opportunities for extending it (Section 4).

2. Related Work

This section begins with a review of literature in the information-sharing paradigm to define relevant key terms that relate to information sharing in groups. Groups have been long studied in this paradigm and results of these studies show that group members fail to share important information that is useful for them to make better decisions (e.g., Dennis, 1996a; Dennis, 1996b; Stasser, Taylor & Hanna, 1989; Stasser & Titus, 1985; Stasser, Vaughan & Stewart, 2000). Next, we review the emergency management and response domain where issues concerning group situational awareness, sense making, and information sharing will be discussed. In sum, this review will synthesize propositions that yield hypotheses to be tested in the current and following studies.

2.1 Information sharing paradigm

In the context of group decision making processes, information sharing and the distribution of available information to the group are important and they may dictate the dynamics of response efforts. The idea of collaborative information sharing and the distribution of information as positioned in the literature will be briefly discussed in this section.

2.1.1 *Information Sharing*

Information sharing processes are thought to have an impact on group work (Annett, Cunningham & Mathias-Jones, 2000; Waller, Giambatista & Zellmer-Bruhn, 1999). Collaborative information sharing in this study is described as a reflection of the characteristics of information dynamics in a context where group members provide information to or acquire information from other members of the group (Devine, 1999; Mennecke & Valacich, 1998). For the purpose of this study, information sharing refers to the process where a piece of information is mentioned during a group discussion. Our definition of information sharing leads to our codification of how a piece of information is defined. A piece of information is any data that can be used to attain any of the identified goals of the response operation. For instance, information on the exact location of victims in reference to relief aids such as food, mobile shelter and first aid may be useful for achieving one of the response goals.

2.2 Emergency Management and Response Domain

In the event of a disaster, whether natural or man-made, sometimes referred to as emergencies, the activities of responding organizations are coordinated by emergency response organizations (EROs) (Mendonça & Wallace, 2007; Stewart & Bostrom, 2002). EROs are typically comprised of representatives from key agencies such as fire department, emergency medical technicians, and police (Belardo, Karwan & Wallace, 1984). Given the high stakes in emergencies, a premium is placed on seeking, handling and managing information in a timely fashion in order to make effective decisions (Klein, Orasnu, Calderwood & Zsombok, 1993; Perrow, 1984). Thus EROs may be characterized as information hubs during emergency response, where problems across organizational boundaries are addressed and decisions made under time constraints (Quarantelli, 1978; Scanlon, 1994). These characteristics make EROs well suited for the study of group information sharing.

Roles in EROs are typically defined before the event but filled during the response by available qualified individuals, perhaps working in shifts, but all sharing common information needs and expectations concerning how their roles are to be performed (Kreps & Bosworth, 1993). An ERO performs six major functions: coordination, policy-making, operations, information gathering, dispersal of public information, and hosting visitors (Quarantelli, 1978). Perry (1991) emphasizes activities of gathering, receiving, maintaining and processing information related to the emergency at hand. The ERO's decisions (e.g., concerning the dispatch and coordination of response personnel and equipment) are communicated to field personnel for implementation. The

ERO's goals for the response may be driven by a combination of exigency and policy. While conflicts are likely to arise (e.g., in tradeoffs between victim and responder safety), these goals must be held in common. By definition, the members of an ERO act interdependently in order to achieve these goals.

Using the key findings from related work as a background, the next section describes our exploratory approach to identifying issues in response activities after the earthquake in Haiti and how they were shared among response teams and to the public.

3. Methodology

This study will focus on the first two weeks of the Haiti response effort to uncover decisions and decision making approaches that could potentially be useful in developing strategies, tactics, and operations for future response efforts. An exploratory approach is taken in this study to unveil phenomena that ensue when teams from several backgrounds collaborate to manage a response effort. The case in point for this study is the earthquake event that occurred on the 12th of January 2010 in Haiti.

3.1 Data and Data Preparation

Data for this study is retrieved from daily situation reports communicated by The United Nations Office for the Coordination of Humanitarian Affairs (UNOCHA). UNOCHA was and still is a prime coordination entity in the Haiti relief effort. The goal of these situation reports is to identify, plan and solve problems in the affected areas.

A working coding scheme is used to identify pieces of information shared during the response effort after the earthquake in Haiti to meet specific response goals. Goals identified in the current study are provision of basic amenities and relief packages to victims. The coding scheme will be continuously modified to adapt to phenomena that arises from the data that will lead to additional goals. A piece of information is regarded as a resource that is available and useful to attain a goal. Resources needed by the earthquake victims to survive include transportation, water, information and communication technology, electric power, and health care services.

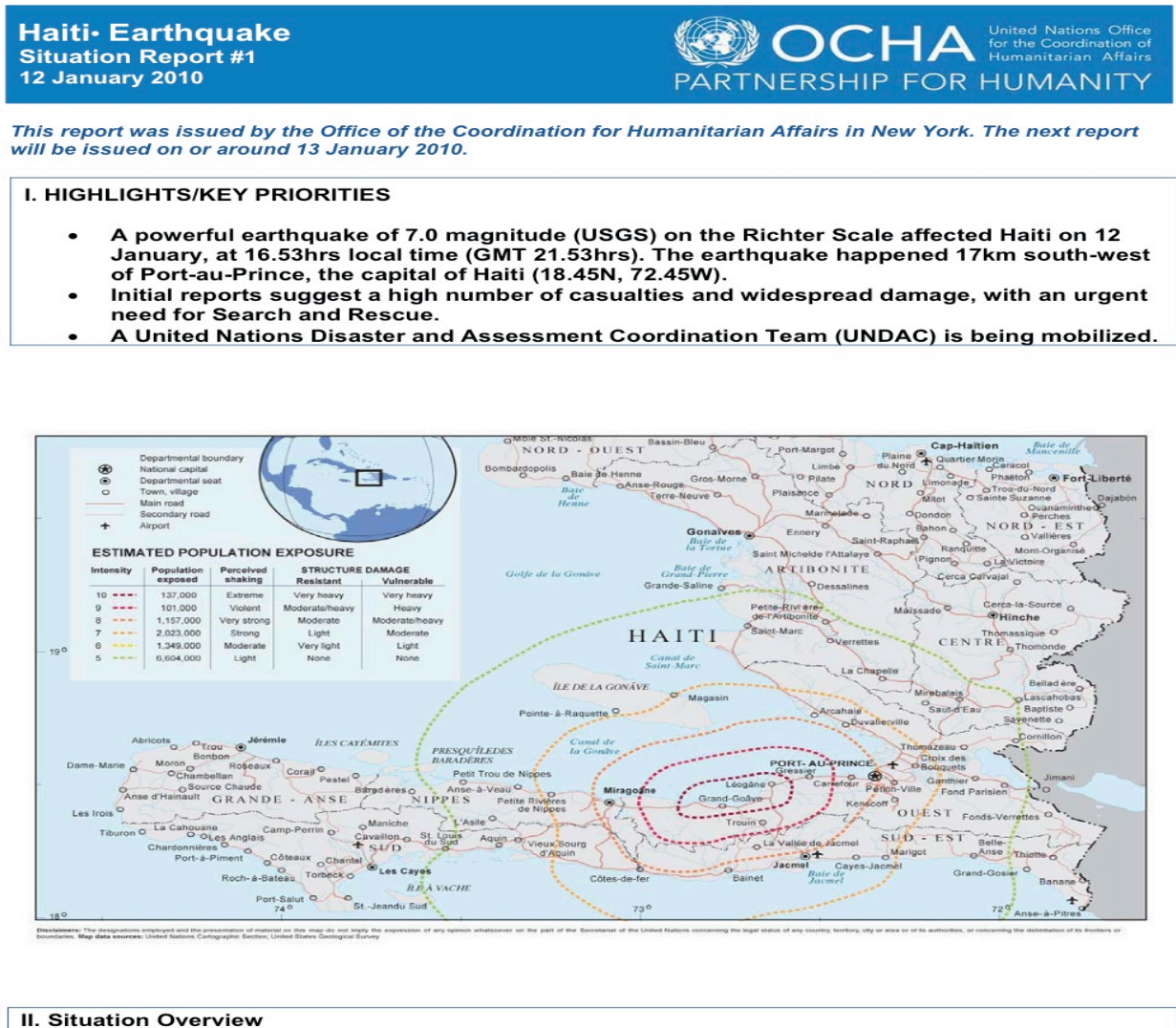
4. Results

Results from coding situation reports from the earthquake are presented in this section on a day-to-day basis. The objective being to capture trends as they unveil themselves over the first two-week period of response activities. For each day, the response goals are reviewed for decisions made for the management of the path to attain the response goal.

After the earthquake struck, announcements from several sources highlighting the current conditions as a result of the event, current responses, and details about the high number of casualties and widespread damage, with urgent call for search and rescue. Based on the UNOCHA reports, three basic response goals were identified and communicated to the public: need for the evacuation of injured; medical supplies and expertise; and, clean

water. The constructs of interest in this study are therefore the response goals and how it is shared in the reports. An image of the situation report is shown in Figure 1. As shown in Figure 1, the situation report is structured such that importance is emphasized both at the top of the document as well as bold fonts. Information considered to be important are recorded in a box titled “Highlights/Key priorities” before a detailed view of the situation is described.

Figure 1. A sample situation report of the earthquake in Haiti



4.1 Data collection and analysis

For data collection, we code the day of the response, the response goal, and the highlight of the report (see Table 1 below). Since we are interested in the first two weeks of the response effort, the day of response ranges from 1 to 14. The response goal data is recorded as a function of the importance (key priorities) of information and response need: (key priorities: response need). Updates in the relief efforts are coded as “highlights.” In a case where the response need portion is not recorded, this suggests that the response goal is considered high priority.

Table 1. Coded data from situation reports

Day	Response Goal	Highlights
1	(Evacuate injured, search and rescue: medical supplies and expertise, and clean water)	
2	(Search and rescue, medical services and supplies, emergency shelter, clean water and sanitation, logistics, telecommunication, food)	
3	(Search and rescue assistance with vital heavy-lifting equipment, medical assistance and supplies: food, shelter, the UNICEF Water, Sanitation and Hygiene (WASH), logistics, emergency telecommunications, agriculture)	
4	(Logistics and lack of transportation: Food, health, WASH, shelter, emergency telecommunications, protection, agriculture)	
5	(Search and rescue, medical services, shelter, food, and water: Logistics, WASH, emergency telecommunication, nutrition)	
6	(Fuel, search and rescue: Logistics, food, health, WASH, shelter, and emergency telecommunication)	13+ lives extracted
7	(Medical assistance, corpse management, shelter, water, food and sanitation: Logistics, WASH, emergency telecommunications, education, protection)	90 lives saved
8	(Medical supplies, water and sanitation, tents, blankets, food and transport equipments: Logistics, WASH, non-food items, emergency telecommunications)	4 live rescues (121+ total)
9	(Medical assistance, food, water, shelter, fuel and transportation equipment: Logistics, WASH, non-food items, protection, nutrition, agriculture, early recovery)	75000 killed, 200000 injured, 1 million displaces. 370 in makeshift settlements
10	(Untreated injuries, shelter, infectious diseases and sanitary conditions: Logistics, health, food, WASH, non-food items, protection, agriculture, emergency telecommunications)	Water is available
11	Information not provided	
12	(Traffic congestion: Logistics, food, health, WASH, shelter/non-food items, nutrition, protection, education, agriculture, emergency telecommunications)	112,250 deaths, 194,000 injured
13	(Logistics, shelter/non-food items, food, health, WASH, nutrition, protection)	
14	(Food and shelter: Logistics, WASH, health, shelter/non-food items, nutrition, education, protection, agriculture, emergency telecommunications)	

4.2 Observations

Five clusters were mobilized on the second day of response to coordinate efforts as shown in Table 2.

Table 2. Five clusters developed (Adapted from UNOCHA situation report #2)

Cluster	Lead agency*
Logistics	WFP
Shelter/Non-Food Items	IOM in conjunction with IFRC
Water and Sanitation (WatSan)	UNDP until UNICEF arrives on base
Health	WHO
Food	WFP

*WFP-The United Nations World Food Programme, IOM-The International Organization for Migration, IFRC-The International Federation of Red Cross, UNDP-The United Nations Development Project, and WHO-The World Health Organization.

Despite the formation of clusters to coordinate efforts from response agencies, the situation reports from Haiti noted that communication and coordination among agencies suffered possibly as a result of lack of structure. Another reason for ineffective communication among agencies might also be that the five-cluster model is not adequate to manage relief agencies with divergent process structures, leading to ineffective sharing of information among response teams. In addition, another factor that might have contributed to slow progress in the early days of the response could be lack of familiarity with a common set of rules of engagement on the part of the response teams. This is possible as response teams are often ad-hoc mash-ups of volunteers not necessarily trained on how to communicate response activities.

The UNICEF WASH initiative took over coordination from the UNDP on the third day of response operations. The only explanation at our disposal at the moment about the transfer of responsibilities from UNDP to WASH is that UNDP is mostly concerned with early recovery efforts. Identifying additional cluster areas to the existing overwhelmed five-cluster model can be seen as a first step towards a structural change in the response operation in Haiti. Twelve cluster areas were identified to help organize the response operations, ensure effective coordination, and leadership.

For the first six days, search and rescue efforts are prevalent and the first highlight (information deemed important) was recorded on the sixth day with information about a specific number (13+) of victims rescued from the debris. An explanation that can be inferred from the reports about highlights been reported may be attributed to the success of the new coordination strategy among relief efforts demonstrated by delegation of goals to agencies with best fit after initial coordination failure after the second day of the response activity.

Table 3. Twelve clusters developed (Adapted from UNOCHA situation report #6)

Cluster	Lead agency*
Camp coordination and camp management	IOM
Education	UNICEF
Emergency Shelter and Non-Food Items	IOM/IFRC
Food Aid	WFP
Logistics	WFP
Nutrition	UNICEF
Protection	OHCHR
WASH	UNICEF
Agriculture and Food Security	FAO
Early Recovery	UNDP
Emergency Telecommunications	WFP
Health	WHO/PAHO

*WFP-The United Nations World Food Programme, IOM-The International Organization for Migration, IFRC-The International Federation of Red Cross, UNDP-The United Nations Development Project, WHO-The World Health Organization, UNICEF-The United Nations Children's Fund, OHCHR-Office of the High Commissioner for Human Rights, FAO-Food and Agricultural Organization, PAHO-Pan American Health Organization.

The observations recorded above draw attention to some key issues that the community of responders needs to start paying attention to in order to be more effective and productive in response efforts. Most notably, inconsistencies are noticed to be prevalent in the form of information delivery. Regular updates are scarcely published about progress report of prior efforts. In addition, when information about daily progress is not shared effectively, effort is difficult to assess by the administrators, or interested potential public agencies, that might want to participate in the relief effort.

A suggested approach might be to assign scribes within each agency to monitor and record decisions made and how it affects one or more response goals. Such reports can be mandated to be of a particular structure in order to foster sharing and easy comprehension within and across agencies. The current state of the situation reports lack detailed information about how many, or an estimate at best, of the resources needed by regions, so that agencies and individuals alike, that might contribute to relief efforts, can come to the aid of the victims in a shorter timeframe.

The information sharing structure of presenting key priorities upfront employed by UNOCHA is useful and can be leveraged by crisis response information systems developers to improve information exchange across agencies. In particular, the information sharing structure holds potential to enable designers to more easily embrace the common alerting protocol (CAP) message generation standard in line with the incident command system standard to enhance interoperability across response agencies.

Finally, it was observed that coordination and communication improved based on the result of the number of victims found during search and rescue, in part as a result of identifying additional cluster areas. This finding is to an extent surprising as it is generally expected that the tendency for miscommunication and disarray is more likely

when there are more groups involved in collective work. On the other hand, the identification of additional cluster areas during the response effort in Haiti might have benefited from division of labor and good leadership to consolidate efforts of individual agencies to make informed decisions on how to delegate resources and manpower effectively and efficiently.

5. Conclusions

This study is a work-in-progress that seeks to understand information sharing strategies by analyzing after-action-reports provided by UNOCHA about the earthquake in Haiti.

Findings reported in this paper provide a roadmap to future studies on understanding information exchange in groups especially in the context of emergency preparedness and management. Coding is still in progress to uncover other phenomena that might have implications on policy, management and scenario development for training future responders. One of the goals of this work is to eventually develop a model for information exchange among emergency responders working under time constraints and varying level of severity. Another related future goal of this research effort is to understand the impact that varying construction of importance of information by relief agencies has on how information is shared and used in order to make effective decisions during response to emergencies. Further studies will explore in more detail the impact of increasing the number of clusters on productivity measured across several dimensions of the response effort.

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