

3-1-2010

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Recommended Citation

Pawlowski, Suzanne D.; Cu, Tung; and Van Scotter, James R., "Knowledge-Related Barriers to Communication and Coordination in Disaster Response: Adelphi Study" (2010). *SAIS 2010 Proceedings*. 23.
<http://aisel.aisnet.org/sais2010/23>

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KNOWLEDGE-RELATED BARRIERS TO COMMUNICATION AND COORDINATION IN DISASTER RESPONSE: A DELPHI STUDY

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ABSTRACT

Multi-organizational ad hoc knowledge networks have the potential to improve the effectiveness of disaster response and recovery by helping organizations share information, coordinate their activities and leverage participants' expertise. This paper reports an exploratory study to identify the major barriers to effectiveness in ad hoc knowledge networks in disaster response. The research methodology is a multi-panel Delphi survey, with each panel comprised of experienced emergency response professionals from different types of response organizations (e.g., fire fighters, EOC (emergency operations center) directors, law enforcement professionals). The study is currently in progress, and results from the first two panels are reported.

Keywords

Disaster response, knowledge networks, Delphi survey, situational constraints

INTRODUCTION

Effective ad hoc knowledge collaboration is a critical element in successful response to disasters, both to reduce human and property losses in the immediate aftermath of an extreme event and to restore the functionality of critical systems and to meet social needs during subsequent recovery efforts (Hiltz, Van de Walle and Turoff, 2010). The environment in which these critical knowledge processes take place, however, presents difficult challenges to the coordination of knowledge and expertise among the organizations involved in response efforts (e.g., federal/state/local agencies, medical facilities, voluntary organizations). Factors contributing to the complexity of these environments are: 1) the diffusion of knowledge and expertise across the network, 2) a variety of formal and informal communication channels, 3) a changing set of participating organizations, and 4) different organizational roles and goals. Network dynamics also contribute greatly to the complexity of the knowledge ecology of disaster response by presenting additional challenges to collaborative information sharing including: an evolving network structure and membership, changing task requirements and resources, and changing knowledge requirements and capabilities. This study is part of a research project to: 1) identify obstacles to inter-organizational communication and coordination in disaster response, 2) investigate the use of knowledge networks across phases of disaster response (e.g., immediate response and sustained recovery efforts), and 3) develop actionable strategies to improve effectiveness. The current study focuses on the first objective, the identification of barriers encountered by different types of response organizations.

While prior research has highlighted the importance of ad hoc knowledge collaboration in disaster response and identified some of the barriers encountered in these situations, the majority of this work has examined the topic within the context of a specific event through after-action reports (e.g., Chua et al., 2007; Dawes et al., 2004; McEntire, 2002). In contrast, our research takes a different approach by examining the topic from the perspective of different *types of response organizations* (e.g., local government, voluntary organizations such as the Red Cross) and different *professions involved in disaster response* (e.g., law enforcement, EMT, fire fighters). Our goal is to gain insights into the challenges of ad hoc knowledge collaboration encountered by specific types of organizations and occupational groups that may arise, for example, from factors such as characteristics of organizational and occupational cultures, and the specific roles and mode of engagement with other types of organizations/response professionals. Through this approach, our objective is to enhance and elaborate the understandings of prior research on interorganizational coordination and collaboration. The study described in this paper represents an initial step in that direction. As a starting point, we are conducting an exploratory Delphi survey with multiple panels representing various types of response organizations and response professions. At this time, two panels have been surveyed – firefighters who have had experience in responding to major disasters and EOC Directors from parishes in the

State of Louisiana. A third panel of law enforcement professionals is being formed. Other panels planned include EMTs and leadership of voluntary organizations involved in disaster response.

RESEARCH APPROACH – RANKING-TYPE DELPHI SURVEY

The research strategy used for the study is a “ranking-type” Delphi study. The Delphi method was developed as a technique to obtain the most reliable consensus of a group of experts (Dalkey and Helmer, 1963). The method provides a structured communication process that includes: 1) feedback of individual contributions of information and knowledge, 2) assessment of the group judgment or view, 3) opportunity for individuals to revise views, and 4) anonymity of individual responses (Linstone and Turoff, 1975). The “ranking-type” variation of the Delphi method variation is commonly used to identify and prioritize issues related to a complex problem (see, e.g., Brancheau, Janz and Wetherbe, 1996; Schmidt, Lyytinen, Keil and Cule, 2001). The methodology used for the current study follows guidelines developed by Schmidt (1997) for conducting a ranking style Delphi study, as detailed in the following section. Multiple expert panels were formed in order to identify similarities and differences in the issues encountered by different types of response organizations.

METHODOLOGY

This section describes the survey methodology followed for each of the expert panels and presents the results of the first two panels: 1) fire fighters, and 2) Louisiana parish EOC Directors.

Selection of Expert Panelists

Expert panelists were identified by referral or by role/position. The criterion for panel participation was that the individual have significant experience in disaster response, including major disasters. We focused on soliciting members of the disaster responder community in the Gulf South, particularly in Louisiana, because of their recent experiences responding to the major events of Hurricanes Katrina and Gustav/Ike. Identification of participants for the fire fighter panel was through referral by the leadership of the Fire and Emergency Training Institute (FETI) at Louisiana State University. For the second panel, e-mails were sent to the parish EOC Directors of Louisiana parishes inviting their participation in the study. (Parishes are similar to counties in other states.) Parish EOC Directors are responsible for coordinating the overall parish response to an emergency.

Table 1 shows that panelists on each of the panels had considerable depth of emergency response experience. All panelists were involved in at least one major disaster response operation (e.g., Katrina/Rita, Gustav/Ike) and most had participated in emergency response for multiple disaster events. Diverse backgrounds and perspectives in terms of different roles and types of disasters were represented on each of the panels.

	Fire Fighter Panel	EOC Directors Panel
Number of panelists	7	6
Average years of experience in the fire fighting profession/ in emergency response	21.3 years	19.3 years
Participation in emergency response to major disasters	Hurricane Katrina (3); Hurricanes Ike/Gustav (5); Other (3)	Hurricane Katrina (6); Hurricanes Ike/Gustav (6); Other (more than 15)

Table 1. Demographics – Panel Participants

Survey Procedure

A ranking-style Delphi survey involves a multi-step process: discovery of issues, determining the most important issues, and ranking of issues (Schmidt, 1997). The initial step is independent brainstorming by panelists. Next, the researchers categorize the input and identify the most important issues. Panelists are then asked to rank the issues by order of importance and to provide input about the rationale for their ranking. Next, the degree of consensus is assessed by the researchers and results are presented to the participants. Panelists are then asked to review/consider the group results of the initial ranking and then re-rank the lists. The goal of the multi-round ranking process is to shape a group consensus. For this study, there were two rounds of ranking.

We used the Qualtrics™ Research Suite software to conduct the Delphi survey on-line, which yielded the benefit of decreased data collection time. Invitation letters containing a link for the initial web-based questionnaire were sent to

qualified panelists. After a few days, a reminder invitation e-mail was sent to potential panelists who had not yet responded to increase the response rate.

Survey 1 (discovery of issues): In the first survey, panelists were asked to describe 6-10 major barriers/obstacles to inter-organizational communication and coordination for disaster response (in the immediate aftermath of an event and the period shortly following the event). They were also asked to provide information about their emergency response experience.

For each panel the input data was consolidated into a single list and then grouped by topic and assigned a descriptive label. (Classification and labeling was done by one of the researchers and reviewed by the other researchers.) For example, a Leadership Capabilities Issues category included input such as: "Those in command are not emergency responders. They are administrators." and "Those in charge do not fully understand the system in which they work." This step produced a list of 18 issues for the fire fighter panel, and 20 issues for the EOC director panel.

Survey 2 (issues ranking – round 1): In the second survey, panelists were asked to rank the issues identified by their panel in order of importance. All issues were retained after round 2 since Schmidt (1997) suggests 20 as a manageable number to rank. We first listed the full set of categorized input (category labels and individual comments), in alphabetical order. Next, panelists were asked to rank the issues from 1-N in order of importance from the most to the least important. In order to avoid any ordering effects, issues were presented in random order for the ranking step.

Analysis of the ranking data included calculation of: 1) mean rank for each item, 2) percentage of respondents placing each item in the top half of their list, and 3) Kendall's W (coefficient of concordance) to assess the overall level of consensus. Kendall's W for the initial ranking of issues by the fire fighter panel was .50, indicating moderate agreement among panel members, and .25 for the EOC director panel, indicating weak agreement. One reason for the low level of agreement among EOC Directors may be that Directors come from different responder specialty areas.

Survey 3 (issues ranking – round 2): The third round involved reconsideration and re-ranking of the issues by the panelists. Issues (category labels and initial input) were presented as in the previous survey, with the addition of the mean rank and percentage of respondents placing the item in the top half of their list. The level of agreement from the previous ranking, based on Kendall's W, was also described.

Kendall's W for the re-ranking of issues by the firefighter panel was .40, less than the prior round, indicating weak/moderate agreement. In a Delphi study, the level of agreement typically increases with each ranking round as participants review the rankings of others and reconsider their previous rankings. In order to understand why this was not the case for this panel, we will review the individual ranking changes in more detail and also explore this in our follow-on interviews. Multiple ranking rounds in a Delphi study typically result in a higher EOC director panel re-ranking of issues is currently in progress.

RESULTS TO DATE

Results of the issues ranking by the two expert panels are shown in Table 2 and Table 3 on the following pages. It is premature to draw conclusions from the limited dataset collected to date, but some preliminary observations can be made. At a general level, it is clear that there are commonalities in the types of obstacles and barriers encountered by the fire fighters and EOC Directors. There are also, however, variations in the specific issues encountered within each type. As a first step in identifying these commonalities and differences, we will apply a framework drawn from the organizational behavior literature. The Situational Constraints framework was developed to understand the types of situational constraints that affect individual work performance (see, e.g., Peters and O'Connor, 1980; Villanova and Roman, 1993). One variant of the framework (from Peters and O'Connor, 1980) identifies eight categories of situational constraints. These categories are shown in Table 4. Although the framework was developed to apply to the level of an individual worker, the same categories will be useful in analyzing the results of the current study to understand situational constraints encountered by organizations in disaster response. Another important step in interpretation of the findings will be to use theory and concepts drawn from the knowledge management and interorganizational communication/coordination literatures. Finally, we will present the output of our analysis to the panel participants for their review and any additional feedback/comments.

It is important to note that one of the limitations of the study in terms of generalizability is the inclusion of panelists from a single geographic region. While the members of the firefighter panel have worked in a variety of locales, the emergency management experience of the EOC Director panelists has been almost exclusively in Louisiana. Some types of issues (e.g., problems with radio systems) may be more/less severe in different regions.

As a follow-on study to deepen our understanding of these issues, we will be conducting facilitated focus group sessions with emergency response professionals attending the National Evacuation Conference to be held in New Orleans in February 2010. In these sessions, we will use the cognitive mapping technique to understand the causal relationships between factors affecting coordination and collaboration in ad hoc knowledge networks in disaster response. The final phase of the research

will be to identify actionable strategies that can be used to address the barriers and obstacles identified through the Delphi survey and focus groups. A primary source for potential strategies to enable changes and improvements by first responder agencies and coordinating groups will be theory drawn from the management, knowledge management, organization science, and inter-organizational communications literatures. A critical element in this step of the research will be to adapt the insights of work in more traditional organizational contexts to reflect and address the characteristics of these complex dynamic organizations, such as rapid obsolescence of information, the emotionality of the situation and inability to observe the actions of other members (Majchrzak et al., 2007).

Issue Rank (1-N)	Mean Rank	Issue Category	Example Input (direct quotes)
1	2.83	Leadership capabilities issues	Agencies/organizational leaders are often unfamiliar with the capabilities and needs of their people, equipment and resources.
2	3.50	Command system issues	Failure of responders, governmental bodies and NGOs to effectively use incident management system structure in an appropriate manner.
3	5.17	Decision-making issues	Organization not sending personnel with the authority to make the decision of the organization to the table.
4	6.00	Lack of planning/preparedness	Organizations not planning for emergencies and not testing their plans to see if they work.
5	6.67	Communication equipment issues	Short supply of communication equipment.
6/7 (tie)	7.33	Bureaucracy/red tape	Too much red tape. When the time comes, it needs to get done.
6/7 (tie)	7.33	Resource issues/logistics	Lack of forward-deployed resources and equipment.
8	8.33	Training issues	Organizations not trained in NIMS (National Incident Management System).
9/10 (tie)	9.00	Manpower issues	Available funding for small volunteer services during a disaster.
9/10 (tie)	9.00	Radio communications issues	Lack common radio channels.
11	9.50	Poor communication (general)	If responders are not able to communicate, tasks or strategies are not likely to get completed efficiently.
12	10.83	Lack of reliable information	Lack of reliable intel from affected areas.
13	11.67	Inaccurate resource/contact information	No accurate list of equipment or trained personnel within the state.
14	12.50	Jurisdictional disputes/own agendas	Not looking at the big picture of the incident – only looking at their own agenda.
15	13.00	Organizational priorities issues	Too much importance is given to certain branches, even when they are not the experts/specialists at the task at hand.
16	13.50	Interoperability issues	Not testing their equipment with other organizations to ensure compatibility.
17	15.17	Outside responders issues	Uncoordinated response from outside first responders and the lack of tracking of such resources.
18	15.33	Terminology differences	Different terminology of the organizations.

Table 2. Issues and Ranking – Fire Fighter Panel – Final Round

Issue Rank (1-N)	Mean Rank	Issue Category	Example Input (direct quotes)
1	3.67	Inadequate funding	A lack of funding for a sector of the local government that is only of use when things go wrong and then the people think you should solve all their problems.
2	5.83	Lack of training and certification for emergency managers	Lack of training and certification for emergency managers. The issue is beginning to be addressed but much needs to be done.
3	6.83	Unprepared agencies' requests for assistance	Unprepared agencies requesting assistance with minute assets immediately following an event that should have been gathered prior to an event.
4	7.00	Circumventing parish EOC	Municipal elected officials attempting to circumvent parish EOC for assistance and assets.
5	7.83	Staffing/personnel issues	State EOC bringing in multitudes of inexperienced guardsmen to answer calls who are unfamiliar with the key players in State EOC.
6	8.17	Communications equipment interoperability/reliability	All agencies on one network or radio system so that you don't have to carry/use different systems.
7	8.67	Responder fatigue, mental stress and nutrition	Low morale sets in with first responders if human resources are not properly managed for rest and nutrition.
8	9.33	Perceptions of the public	Perceptions of the public. We do not do a good job selling ourselves to the public.
9	10.00	Multiple agency requests for shelter information	Shelter reporting. Have one group responsible for collecting shelter information, not each state agency making their own requests.
10/11 (tie)	11.00	State and/or FEMA doubting initial damage reports	I attribute delays in our parish receiving initial commodities and supplies due to this disbelief.
10/11 (tie)	11.00	Unclear expectations for EOC Directors	Understanding what is actually needed or expected as a result of your participation.
12	11.50	Problems communicating/sharing among agencies (general)	Inability to contact the key players in the (state) EOC that parish directors normally deal with.
13	12.17	Space issues in EOC to house all agencies needed	Space issues EOC to house all agencies needed to respond to a disaster.
14	13.50	Confusion about what information is official	Confusing about what information is "official information."
15/16 (tie)	13.67	Difficulty getting accurate information from rural areas	Inability to get an accurate report of the totality of the damage from the rural areas of the parish.
15/16 (tie)	13.67	Politics and turf battles	As an Emergency Management Director you get hammered when it is perceived that one entity receives something that someone else didn't get, no matter what the reason is.
17	14.33	Space issues - shelters	Insufficient space for special-needs shelters
18	14.50	Media outlets – communications and coverage	Media outlets calling parish EOC/JIC continuously.
19	14.67	Decision making issues	FEMA liaison to parish not given enough authority to expedite needs requests.
20	15.17	Infrastructure damage	Damage to infrastructure that cannot easily be restored or replaced.

Table 3. Issues and Ranking – Parish EOC Directors Panel – Initial Ranking Round

1. Job-Related Information
2. Tools and Equipment
3. Materials and Supplies
4. Budgetary Support
5. Required Services and Help from Others
6. Task Preparation
7. Time Availability
8. Work Environment

Table 4. Situational Constraints/Resource Variables
(from Peters and O'Connor, 1980)

ACKNOWLEDGMENTS

This material is based upon work supported by the US Department of Homeland Security under Award Number: 2008-ST-061-ND 0001.

DISCLAIMER

The views and conclusions contained in this document are those of the authors and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the US Department of Homeland Security.

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