2007

Mitigating disaster: mapping cognitive processes in applying technology to crises

John Clinton Borne
Louisiana State University and Agricultural and Mechanical College, jcb@lsu.edu

MITIGATING DISASTER: MAPPING COGNITIVE PROCESSES IN APPLYING TECHNOLOGY TO CRISES

A Thesis

Submitted to the Graduate Faculty of the
Louisiana State University and
Agricultural and Mechanical College
in partial fulfillment of the
Requirements for the degree of
Master of Science

In

The Department of Information Systems
and Decision Sciences

By
John C. Borne
B.S., Nicholls State University, 1982
May 2007

Acknowledgements

In thinking about the people who have made this work possible, there are a number of individuals and groups that were vital to its accomplishment.

I feel the place to begin is by thanking my wife Rhonda, my sons Joshua and Michael, and my extended family for giving me the extensive amount of time, and frequently, the personal space to pursue it. It would have been impossible without their active support.

The second group I would like to thank is my thesis committee, Dr. Suzanne Pawlowski, Dr. Andrea Houston, and Dr. Edward Watson. They have helped me reach this point through their teaching, advice, and the gift of their wisdom.

Next, I would like to thank my supervisors and co-workers who have supported me through my years of study. It would have been extremely difficult without their patience and support.

I would also like to thank all of the professors I have had the privilege of learning from over the past four years including Dr. Ye-Sho Chen, Dr. Daniel Rinks, Dr. James Van Scotter, Dr. Stacy Furst, and Dr. Victor Mbarika. I learned a great deal from each of them and always from a unique perspective.

Finally, I would like to thank all of the contributors to this study for allowing their knowledge of a unique and historic event to be captured and used to try and extend our knowledge of the dynamics of extreme events.

Table of Contents

List of Figures

Abstract

Extreme events are sometimes defined as unexpected events in which local resources are insufficient to cope with the extent of the damage and require outside resources to address the hazards specific to the event. For that reason, communities immediately adjacent to disaster areas have a unique and important role in the study of measures to mitigate the effects of the resulting hazards to human life and property. This exploratory study looks at the use of information technology in conjunction with disaster mitigation activities in areas adjacent to a large disaster. The experiences, thoughts, and beliefs of individuals involved in mitigation activities at Louisiana State University immediately following Hurricane Katrina and the resulting large scale evacuation of New Orleans were captured through interviews in which cognitive maps were developed. Through a Grounded Theory approach, the data was analyzed for theoretical fit. In the early analysis the data grouped itself into three main stories; the Implementers, Decision Makers, and the Vendor stories.

The best theoretical fit was found in elements of Improvisation Theory. Specifically, alignment was found in the use of "Bricolage" in solving problems, the unique elements that resulted in a climate of openness to improvisational processes, and the improvisation of command and control. Finally, other research questions that came up in the course of the study are examined.

Chapter 1 - Introduction

Extreme events, or disasters as they are more commonly known, occur at a random, but nevertheless regular rate. Still somewhat unpredictable despite advances in safety procedures, federal protection and mitigation projects, and meteorological predictive modeling, they wreak damage that currently stretches into the billions of dollars and is increasing each year at a rate well in excess of inflation. The figures in Figure 1 illustrate the rise in the cost of natural disasters over the course of the second half of the 20th century. (http://earthobservatory.nasa.gov/Study/RisingCost/rising_cost2.html)

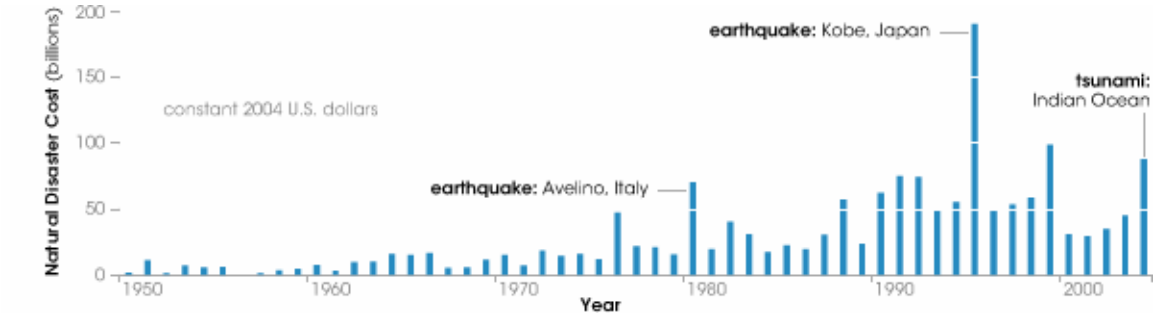


Figure 1.1 Rising Cost of Natural Disasters (Graph by Robert Simmon, based on data courtesy EM-DAT: The OFDA/CRED International Disaster Database (www.em-dat.net) Université Catholique de Louvain—Brussels, Belgium)

While arguments about the effects of climate change are currently being developed and made, the reasons for the rise in cost are less about climate change than they are about human and technological change. Today's populations are obviously larger than in the past. But increasingly, more people are choosing to live in to areas that pose higher risk to damage from natural and man-made hazards. Human beings have a great desire to live in areas where they can enjoy the beauty of nature on a continuous basis. The problem lies in the fact that the beauty of coastal shorelines, hillsides, and geologically unstable areas bring with them higher risks to natural hazards. Another desire of human beings is for convenience. Populations of workers have built communities ever closer to industrial sites increasing the risks of man-made events.

Another factor in the rising cost of extreme events is the technology-based society that has developed over the last decade following the creation of the Internet. Computers and electronics have penetrated nearly every facet of our lives. However, electronic equipment is much more sensitive to damage and much less repairable than the industrial strength equipment of previous generations.

Finally, business today is much more efficient and has embraced just-in-time methodologies in supply chains to a larger degree. The result is that business organizations are much more interdependent on each other and sensitive to interruptions to the supply chain thus making those interruptions more costly.

The hurricanes which struck the Louisiana and Mississippi gulf coasts in 2005 left an indelible mark on the cities, the towns, and the people who inhabit those regions. These communities have a long experience with natural disasters and the rebuilding process as a result of the seasonal storms that visit it every year. But the magnitude of the disaster wrought by Hurricanes Katrina and Rita had no equal in the life experience of the inhabitants of coastal Louisiana and Mississippi. The extent of the damage was such that while the effects of the storms may have been minimal a mere one hundred miles inland from the coast, the impact on New Orleans sent ripples that reached the entire breadth of the country. As might be expected, the impact on the areas adjacent to New Orleans and the Mississippi Gulf Coast, while a mere fraction of those areas and not comparable by any measure to the disaster sites, was still considerable. The flow of evacuees from the large New Orleans metropolitan area put strains on the infrastructure and society of the surrounding areas.

Extreme events are sometimes defined as unexpected events in which local resources are insufficient to cope with the extent of the damage and require outside resources to address the hazards specific to the event. For that reason, communities immediately adjacent to disaster areas have a unique and important role in the study of measures to mitigate the effects of the resulting hazards to human life and property. This study looks at those efforts, and specifically the information and technology aspects

of those efforts, through a Grounded Theory approach to attempt to learn from one of the largest natural disasters that the U.S. has experienced in recent times.

Figure 1.2 Critical Care Facility, Louisiana State University, 2005

Chapter 2 – Literature Review

2.1 Disaster Studies

Depending on your definition of "Man", humans have been subjected to natural disasters since their arrival more than three millennia ago. In more recent times man has contrived to invent a few disasters of his own and found new ways to expose himself to and exacerbate the effects of nature. As the world's population has grown, these "extreme events" have caused uncounted loss of life and property. In addition, the growth of societal networks (communication, transportation, supply) and the complexity of human organization have magnified their effect. Despite this fact, research of these extreme events as an organized field of study is a relatively new development. Only in the last few decades has a noticeable body of work begun to be published especially following the man-made event of 9/11 in New York City and the natural disaster wrought by Hurricanes Katrina and Rita in 2005. Researchers who have recognized the need to understand these events have begun to try to define and organize the topics that are encompassed today through disaster studies.

To gain an understanding of the field of disaster studies, we should perhaps begin with a definition of a disaster or "extreme event." However, researchers have not found that task to be a simple one. The website "thefreedictionary.com" (http://www.thefreedictionary.com/) provides the following definition, "An occurrence causing widespread destruction and distress; a catastrophe." Another definition comes from the website of the Journal of Prehospital and Disaster Medicine (JPDM as of 2007) (http://pdm.medicine.wisc.edu/vocab%20new.htm accessed 1/15/2007). "A serious disruption of the functioning of society, causing widespread human, material or environmental losses which exceed the ability of affected society to cope using only its own resources." This second definition captures the element of a disaster that is commonly recognized as distinguishing these types of events from others. It describes the

characteristic of disasters as typically requiring assistance over and above that available from local government and resources. Disasters require or compel other, unaffected resources or organizations to come to the aid of the stricken area. It is this quality along with the tremendous cost in lives and property that has caused extreme events to become an emerging theme in research today.

A perspective on the part of researchers that might seem unusual at first is the observation that while there are indeed negative effects of disasters, there are also positive effects (Pielke and Sarewitz 2000). For example, a flood may devastate an agricultural area, but the flood waters may enrich the soil, enhancing crops in subsequent years. By far, and unfortunately, the most beneficial effects of extreme events are the knowledge and experience gained from them and the hope that the lessons learned can be used to mitigate other events.

Presently, a good deal of disaster research focuses on studying decision making and improvisational processes that organizations undertake in responding and mitigating extreme events. The use of social network modeling techniques, group decision support tools, and techniques that capture cognitive and behavioral processes are also seen as appropriate to developing data about organizations involved in these types of events (Mendonca and Wallace 2004).

2.1.1 Capturing and Assimilating Lessons from Extreme Events

One of the salient questions in disaster studies today is why, considering the regular occurrence of disaster, we have not learned to more effectively anticipate, respond, and mitigate these events (Donahue and Tuohy 2006). Donahue and Tuohy (2006) state that true learning from these events is much more difficult. The case studies and other documentary evidence are there, but they seem to be either un-communicated or when communicated, presented in a way that the lessons are situationally specific and cannot be generalized to other types of events.

The problem of communicating the lessons from an event may be because the lessons are viewed from a phenomenological perspective and rarely related in a structured way and communicated in the context of the common set of adverse effects that disparate extreme events produce. This means that while phenomena that cause extreme events are disparate, there are common effects. For example, the disruption of communications, contamination of water supplies, and displacement of populations could be considered common effects caused by either an earthquake or a hurricane. It is now understood that different types of events may have very similar immediate consequences for responders and similar long-term consequences for society.

2.1.2 The Future of Disaster Studies

Despite the focus on the phenomena that cause disasters, from a positive perspective, specialized knowledge is being developed to address the causes and effects of extreme events. However, the lack of collaborative cross-discipline focus on the effects of these events may lead to research in disasters becoming balkanized and leave the real lessons of extreme events unlearned (Pielke and Sarewitz 2000). Areas of ongoing research include the use of remote sensing, communications and information systems, warning and response strategies, decision making processes, community vulnerability, and methods for learning and creating useable knowledge from extreme events. The contention is that what is lacking is an integration and collaboration of research efforts.

Under increasing study today in connection with disaster research is the area of decision support systems. Mendonca, drawing from previous research in jazz improvisation, pursued research into developing requirements for decision support software systems that could assist organizations in determining not only how to improvise in the response to extreme events, but also when to improvise (Mendonca 2007). In his study, Mendonca used data collected from subjects who participated in the response to the 2001 World Trade Center attack. He used a

cognitive task analysis method called the critical decision method which entails semi-structured interviews that seek to elicit knowledge about decision making in relation to the event and develop new knowledge based on a subject's experience.

The use of graphical tools in methods of sense-making of extreme events is another area of study. In an attempt to understand the cognitive processes of emergency responders, Alexander (2004) conducted a study of the ability of individuals to visualize the circumstances of extreme events and capture their thinking about the appropriate responses to those events. His study entailed having emergency managers develop spatial cognitive maps for a simulated event. Through the study he found that individual thinking and retained knowledge about a single shared event varied to a large degree. This finding underscored and re-emphasized the critical role communication plays in managing and decision-making in connection with an extreme event.

By far the most prevalent research in relation to disasters is the case study. In a study of the events surrounding a toxic cloud crisis near Nantes, France in 1987, Roux-Dufort looked at failures to improvise and incorrect decision-making among four groups involved in the response to a fire that produced a cloud of potentially toxic fumes (Roux-Dufort and Vidaillet 2003). The conclusions from the study pointed to the presence of multiple, uncoordinated groups as elements in the lack of improvisation and good decision-making in the course of the event.

The study of the phenomena of disaster and their effects has now begun to move towards efforts to distinguish and classify events that are predictable from those that can be understood but not predicted. This research, combined with a new focus on the commonality of effects between different event types, is expected to contribute to methods of effective elicitation of data for disaster studies.

2.2 Cognitive Maps and Mapping

The development of Cognitive Mapping as a technique for capturing the "thinking" surrounding a problem or situation has been ongoing for decades and stems from the work of Tolman (1948) and from the theory of personal constructs developed by George Kelly (1955) (Eden 2004). Personal construct theory proposes that people make sense of their world by seeking to manage and control the conditions and environment around them. Because of that focus on an individual's world as a series of problems, cognitive mapping is considered a valuable tool in capturing the thoughts and beliefs, or cognitive processes, of an individual about those problems. Among other things, cognitive processes can include an individual's perceptions and interpretations of an event or issue, and decision rules and strategies for dealing with uncertainty (Axelrod 1976). At a higher level, cognitive maps may chart the connections between organizations and the environment within which they operate. The connections that tie our world together and that we attempt to capture in cognitive maps are the connections that tie thought together (Bougon, Weick et al. 1977).

What exactly are cognitive maps? The various definitions put forward by the many authors who have written and researched their identification, construction and analysis all sound somewhat similar, but each one contributes to an understanding of what cognitive maps are and where their value lies. Cossette and Audet (1992) defined cognitive maps as "graphic representations of a set of discursive representations made by a subject with regards to an object in the context of a particular interaction" (Cossette and Audet 1992, p.327). That definition underscores the fact that it is the assertions made by a subject about a particular issue that are what is captured in the map. The definition, or description, by Fiol (1992) that cognitive maps are "graphic representations of an individual's thinking about a particular problem" and "provide a frame of reference for what is known and believed" is very similar to that of Cossette and

Audet and underscores the fact that cognitive maps are fundamentally graphic depictions of thought (Fiol and Huff 1992).

Before accepting the purpose and value of cognitive maps, however, many authors caution against any assumptions of the empiricism of cognitive maps. While the term cognitive map implies a map of the thought and belief of an individual or group, there are considerations to be made before accepting that premise entirely. The "truth" or "reality" of a map is dependent on the adequacy of the theory underlying the model and on the method used to elicit the map (Eden 1992). In addition, the thoughts and beliefs that are revealed in the construction of a map may be very different from true reality and might indeed, change at any given point in time and as memories age over time (Fahey and Narayanan 1989). Finally, cognitive maps suffer from limitations in our abilities to quantitatively analyze the data they contain and their limitations in capturing thought that is not cause-effect based (Axelrod 1976). However, cognitive maps have a special value in understanding human sense-making of complex situations and have a strong claim as a method for communicating that sense making. More reasonable claims for cognitive maps are that they have the capacity to represent subjective data in a meaningful way and can contribute to a process of decision making, problem solving, and negotiation (Eden 1992).

2.2.1 Efficacy of Cognitive Maps and Mapping

However imperfect cognitive maps may be in capturing reality, it is that quest to attempt to capture and communicate the reality of complex issues that attracts researchers to it and other methods. The value of an empirical method of recording human cognition in relation to problems that vex society would be tremendous. In the absence of such a method, cognitive mapping has become a leading technique in attempts to bring structure to problems and to analyze them. One benefit of cognitive mapping is in its ability to surface the central concepts of an issue frequently referred to as the "nub" of an issue (Ackerman, Eden et al. 1992).

Frequently, these core goals or options are known, but their relationship to other goals or options and to each other are frequently elusive. Cognitive maps also bring the various detail of a problem and the chain of an individual's thinking about that problem into a single focus (Fahey and Narayanan 1989). At the same time, the technique attempts to overcome the limits of humans to perceive, understand, and make sense of problems, and to think beyond their immediate context or reality and the imperfection, impermanence, and mutability of human memory (Laukkanen 1994). Finally, in today's uncertain world, researchers contend that cognitive maps are important tools in understanding organizational contexts and provide a new way to examine and improve managerial decisions and judgment (Fiol and Huff 1992).

2.2.2 Elicitation Methods

Researchers have described several methods for eliciting the data required to develop cognitive maps and each of these methods has particular strengths and limitations. The three method types were described by Axelrod in 1976 and include derivation from existing documentation or text, questionnaires, and face-to-face interaction (Axelrod 1976). The derivation of maps from documents is considered a valid and reliable method of elicitation. The limitation of the method lies in the data being essentially fixed with no opportunity to further develop or enhance the data. Thus the map is available to the researcher.

The use of questionnaires for developing data is a popular method today. This method is considered superior to document analysis due to its flexibility in capturing a wider range of information. There is current debate that questionnaires such as the Self-Q instrument developed by Michel Bougon may be superior to other methods including open-ended interview techniques (Eden 2004).

The third method of deriving cognitive maps entails the use of face-to-face individual and group interviews for developing data and in many cases for concurrently developing the map

itself. The advantage of this method is that it allows the researcher to interact with the source of data and pursue concepts in the course of the interview. This method can be further categorized by whether the data and/or the map are developed from a single individual or a group of individuals. Another scenario combines the individual and group approaches by aggregating individual maps to form an aggregate group map.

2.2.3 Map Construction

The mechanics of constructing a cognitive map on the surface seem relatively easy. They are composed of conceptual "nodes" based on what is said by the individual serving as the data source and arrows linking those concepts together. The linking arrows are qualified by positive and negative signs to indicate whether they facilitate a particular goal or option or whether they obstruct it. As simple as that sounds there are several hurdles to developing a credible map (Ackerman, Eden et al. 1992). One of the obvious problems is that it is exceedingly difficult to listen, understand what is being said, and construct the map concurrently. Developing this ability takes some measure of time and practice. Another pitfall that researchers new to cognitive mapping run into is their tendency to try and record everything that is being spoken by the data source. A certain amount of what is said in an interview is repetitive but couched in different wording. Finally, difficulties arrive in simply managing the recording of the map on paper. In the development process the map may tend to look disorganized, but the use of A4 size paper and beginning the map two thirds of the way up the page help to reduce that disorganization allowing "head" nodes or core concepts to float to the top and "tails" or options to float lower in the map. Head nodes frequently correlate to the goals of the problem and tails to initial options or conditions affecting the achievement of those goals.

2.2.4 Analysis of Maps

As mentioned previously, researchers have long known that maps are resistant to quantitative analysis, but the analysis of cognitive maps has shown that it is possible to bring to light information that would otherwise be difficult to obtain (Cossette and Audet 1992). Over the past several decades several methods of analysis have been identified that can be applied to cognitive maps. Some of the methods include cluster analysis, looking for potent nodes or options, virtuous and vicious cycles, central issues termed "nubs", and shape (Eden 2004).

Cluster analysis involves looking for groups or "islands" of related concepts within a larger map of interrelated concepts that have few or even no relationships with other groups. Once identified, the analysis of these groups can be pursued along two paths. The clusters can be analyzed without taking into consideration connections to other groups or they can be looked at by including the relationships they may have to other clusters.

Maps can also be analyzed by looking for "potent" concept nodes or options that may appear in multiple clusters that may indicate central themes. These potent nodes are frequently an indicator of a core concept regarding the problem.

Virtuous or vicious circles (sometimes referred to as cycles or loops) are another characteristic looked for in cognitive maps. A circle with an odd number of negatively signed arrows indicates a vicious circle if the resulting goal is considered an undesirable one. Changing the map by removing one of the negative arrows or causations, transforms the circle to a virtuous one.

Searching a map for "nub" issues is another method of map analysis. This type of analysis is also called domain analysis because it looks at the total number of in arrows and out arrows from a specific node to find significance. The measures of the number of in arrows and out arrows of a node are also called the in-degree and out-degree of a node.

The shape of the graphic generated by the mapping process, while considered problematic, can also be a characteristic for analysis. A generally flat shape indicates little depth in the thinking about a problem, but an awareness of a large number of options. A tall, thin shape suggests few options, but a greater depth of understanding of an issue. Individuals inexperienced in cognitive mapping tend to generate maps with fewer concepts and more arrows than more experienced researchers.

Recent research has begun to focus on detecting and analyzing change in maps over time in order to understand to what degree maps remain consistent and to study the forces influencing change if detected. There is also interest by researchers in the value of cognitive maps in highlighting priorities relative to issues and their effectiveness in supplying information that may be missed by current mapping techniques and theory (Fiol and Huff 1992).

Chapter 3 - Research Method

3.1 Data Collection

The method of data collection and analysis for the study was based on the works of Kelton, and Ackerman and Eden (Eden 1992; Kelton, Mendonca et al. 2000). In "Acquiring and Assessing Knowledge from Multiple Experts using Graphical Representations," Kelton discusses a number of methods for eliciting expert knowledge from individuals and recording that knowledge using graphical methods. One of the methods they discuss is the use of cognitive maps to capture expert knowledge from individual or group interviews. In order to better understand the cognitive mapping method, Ackerman and Eden's white paper on cognitive mapping, "Getting Started with Cognitive Mapping," was used to gain insight into the method of eliciting and constructing individual maps.

3.1.1 Subject Selection

The source of data for this study came from the population of southern Louisiana citizens who experienced the effects of Hurricanes Katrina and Rita and were involved in applying technology in the response to the effects of those events. The primary participants targeted for the study were current and former employees of LSU who were involved in making decisions about, developing, or implementing technology solutions as part of the LSU campus response and mitigation efforts related to Hurricane Katrina. A second source of participants was employees of Louisiana universities or agencies who were involved in similar technology and response activities as a result of the hurricanes.

In recruiting subjects for this study, potential subjects were identified by looking at their role at the University and the role's potential for the type of involvement in extreme events that are of interest in the study. Typically, they were persons in technology leadership and implementation positions. Special attention was paid to individuals who operated at the CIO or

CIO staff levels, departmental IT coordinators, technology architects, computer analysts, and communications and computer technicians. They were initially contacted via e-mail. The e-mail described the study, the researchers, and the nature of the participation being requested of them. Other participants were revealed based on referrals from participants contributing to the study.

3.1.2 Interviews

In order to develop the procedure for data collection, two pilot interviews were conducted and the technique for developing cognitive maps refined. The pilot interviews were recorded and the recordings used to validate and further develop the maps. The informed consent briefing and forms were also included in the pilot process. The data elicited in the pilot interviews was included in the complete set of data used in the study.

The larger body of interviews, consisting of an additional eight subjects, was conducted in settings chosen by the subjects. The duration of the interviews ranged between 45 and 65 minutes. During the course of the interviews, the maps were developed interactively with the subject to insure continuous validation of the maps. The complete interviews were audio-taped in order to capture further detail from the subject and for later validation of the constructed maps. See the Interview Guide included in Appendix A for the basic flow and structure of the interviews.

3.2 Data Analysis

The process of data analysis involved all three types of data captured in the course of the ten interviews. The three data types included the cognitive maps developed in the course of the interview, the transcripts of the interviews, and to a limited extent, the tapes of the interviews. The tapes were used in addition to the transcripts in cases when it was felt a richer communication medium was needed to understand the stress or importance of particular statements made by the subject. The data was analyzed qualitatively for major themes within the

set of data recorded for each subject. The process of analysis was influenced by the work of Baskerville, and Ackermann and Eden (Baskerville, Pawlowski et al. 2000; Eden 2004). Early in the process, groups emerged from within the data along the lines of roles in connection with the subjects' experiences during the event. The subjects aligned into three groups which were labeled "implementers", "decision makers", and "vendor". The implementers group was composed of four individuals who were, in many cases, directly engaged in installing and/or operating the IT equipment and systems used in the effort. The decision makers group consisted of five individuals who acted in capacities closer to the point where decisions on efforts and resources were made. Finally, the vendor group represents a middle group operating sometimes within the other groups and more frequently, between the other two groups. This group consisted of a single individual who was present throughout the time that the emergency facilities remained open at LSU and participated in most, if not all, of the IT initiatives connected with the emergency efforts. The resulting themes were studied in the context of several theoretical constructs including improvisation (Wachtendorf 2004), adaptive structuration (DeSanctis 1994), and social theory (Bogard 1988). Improvisation theory was selected as the best fit based on the developed themes. Based on the selection of improvisation theory, the cognitive maps were revisited and a group map, or story, was developed from the collected maps of the group. Each of the stories revolves around several goals that the group identified as their primary focus during the event.

3.2.1 Implementer Story

The map for this story can be found in Figure 2.1. One of the first goals for this group, even before evacuees began arriving, was to set up a communications network for the emergency agencies arriving on campus (1). The campus facilities designated for emergency operations had little Internet and voice network connections so a number of approaches were followed to meet

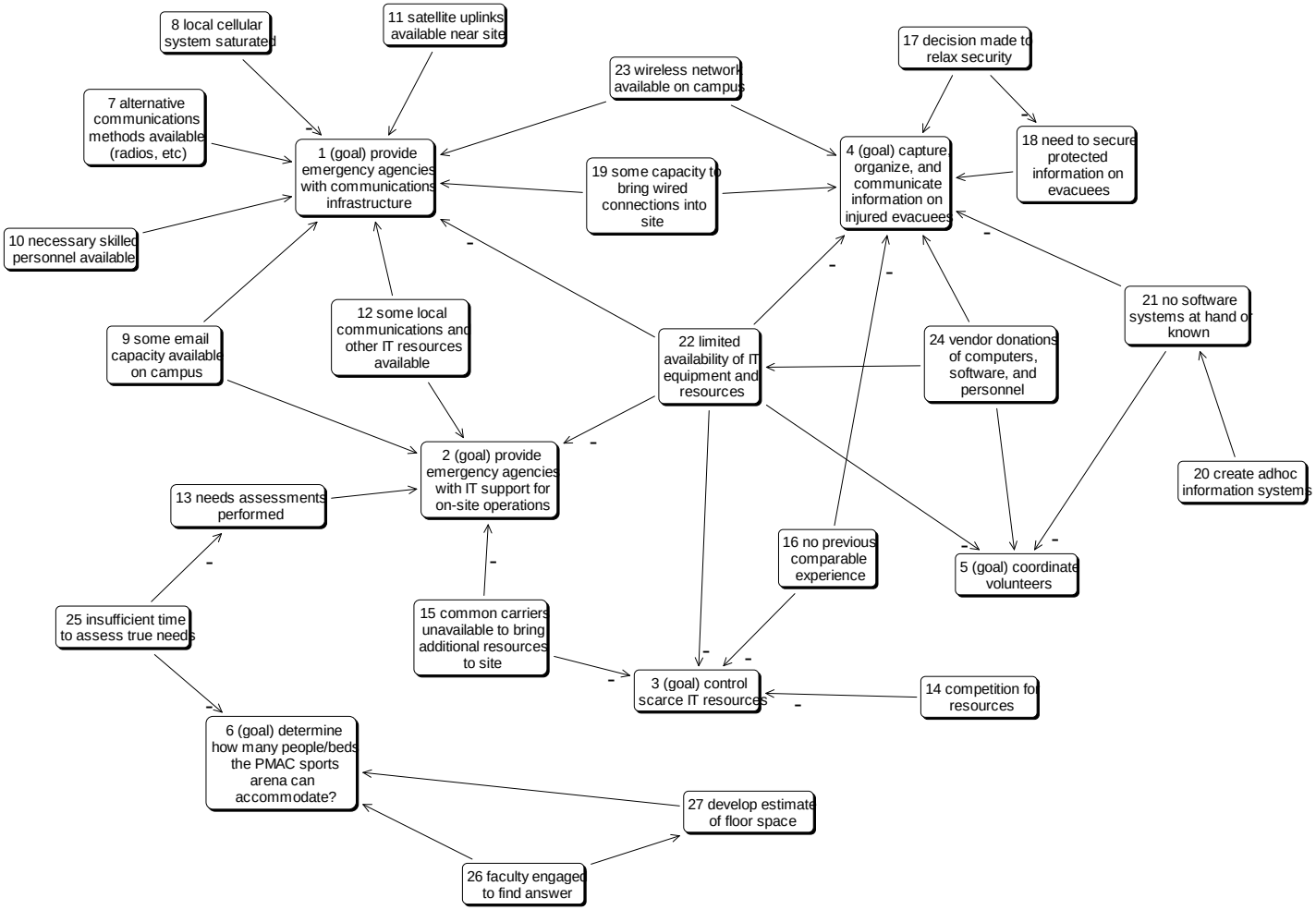


Figure 3.1 – Implementer Cognitive Map

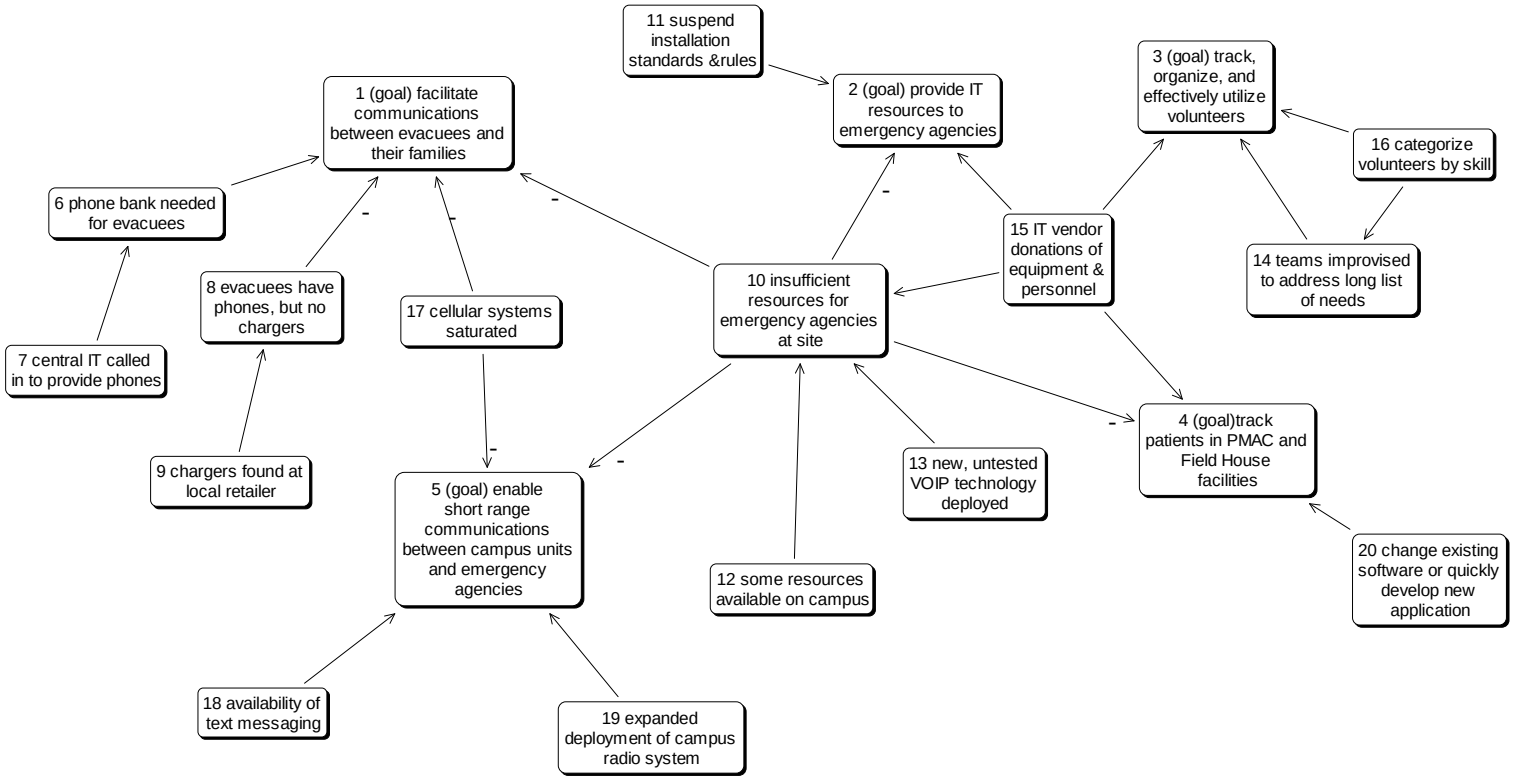


Figure 3.2 – Decision Maker Cognitive Map

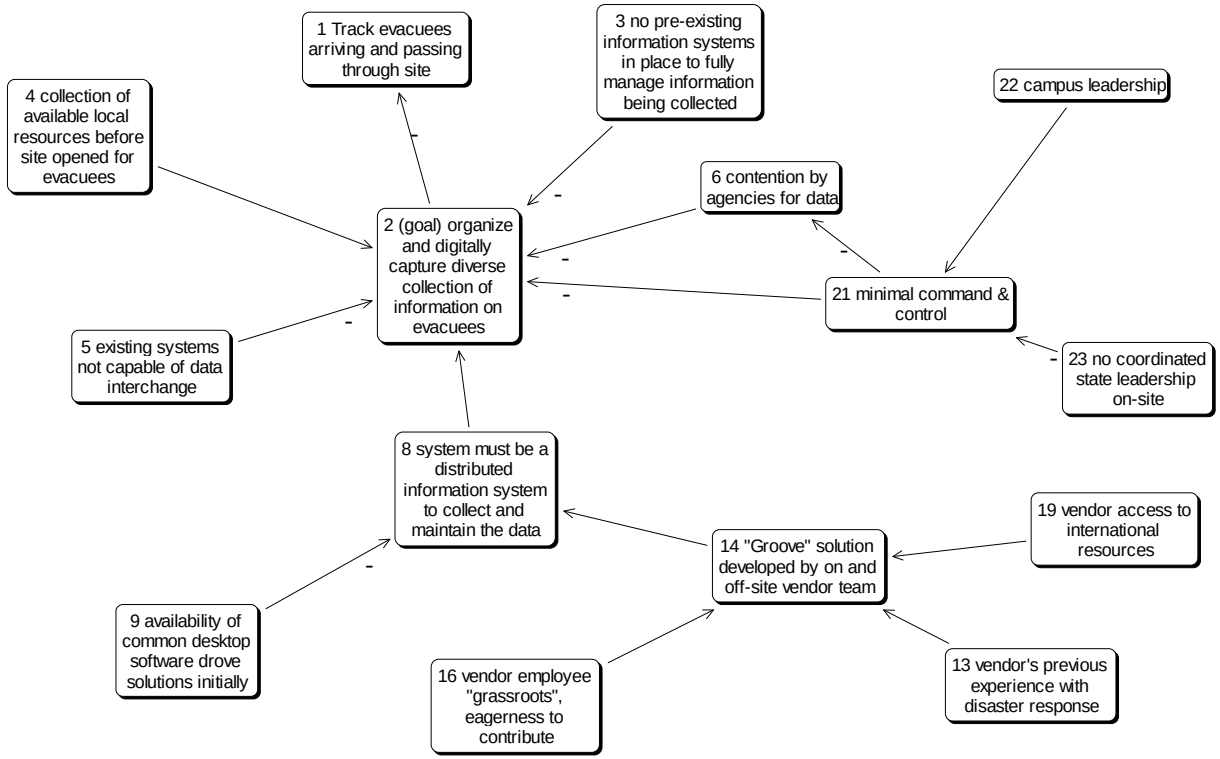


Figure 3.3 – Vendor Cognitive Map

this goal including bringing in additional IP network connections (19), leveraging the existing campus wireless network (23), and alternative communications such as handheld radios (7). Cell phones were of little or no use right after the hurricane as the cellular systems was saturated with call attempts from individuals attempting to make contact with family members (8). It was several days before the cell system could be utilized to any serviceable degree. E-mail services were available from a margin of excess capacity in the central campus system (9). The presence of some skilled personnel and equipment from the central campus IT organization allowed a communications network to ultimately be put in place (10) (12).

The next goal identified by the implementers group entailed providing IT agencies at the sites with general IT equipment and support (2). Despite the time constraints of the situation (25), the IT staff took the time to conduct a needs assessment in order to determine the entire picture and prioritize the distribution of limited resources (13). The limited resources situation was exacerbated in the first weeks following the hurricane due to the restrictions on shipping into the Baton Rouge area (15).

In the short time before the campus had to be made available to state and federal emergency agencies (25), the capacity of available facilities in terms of people and beds had to be established (6). Faculty members were contacted and asked to help determine those capacities (26). One of the first things they focused on was calculating the total floor space of the facilities (27).

Many of the agencies that came to setup operations on campus arrived with little or no IT resources to support their operations. Thus, the demand for IT resources was much higher than the available resources (3). The lack of space on common carrier shipping resources prevented one avenue of solution to the problem (15), and the competition for the limited resources became

predictable as agencies argued with IT staff about why they should receive preference in the allocation of resources (14).

As the evacuation of New Orleans gained momentum, evacuees were being transported to the far corners of the state and the country. Families were separated from each other with no means of finding each other even if they were within a hundred yards of each other. A common goal mentioned across many of the interviews was the need to capture, organize, and communicate information about evacuees passing through the emergency facilities (4). The issue of securing the data being captured was an immediate concern (18), but the urgency of getting the process underway made it obvious that normal security measures could not be put in place (17), and the unencrypted wireless and wired network connections were used to exchange, synchronize, and transmit data (23) (19).

A final goal described by the group was the need for a system to capture information on the thousands of volunteers showing up to contribute to the efforts so that they could be scheduled and allocated to specific tasks and any special skills exploited (5). Since no existing systems or COTS software was known to fit the situation (21), it was determined that an ad hoc solution should be developed as quickly as possible (20). An IT vendor who happened to be on campus was consulted and arranged for the use of licensed software and programmers to quickly customize software originally developed following the 2004 Tsunami disaster (24).

Finally, many of the subjects in this group described having no previous experience that they could compare with this event (16), and the constant struggle to accomplish so much by pulling together, in many cases, odds and ends of equipment and personnel (22).

3.2.2 Decision Maker Story

The map for this story can be found in Figure 2.2. One of the first goals identified by this group was to find a way for evacuees to communicate with their extended families living outside

of the disaster area (1). Many of the evacuees had cell phones, but due to the saturation of the cellular network and the fact that few of the evacuees had chargers for their phones, cellular service was insufficient to play a significant role in the initial solution to this problem (17) (8). However, chargers were acquired to contribute to the efforts at a solution (9). At that point the campus central voice services group was called in to provide assistance in setting up a phone bank for the evacuees (6) (7).

A second goal identified by this group was to provide IT resources to emergency agencies (2). This situation presented itself almost immediately as the numbers of evacuees quickly overwhelmed the few IT resources that the emergency agencies brought to the site (10). Fortunately, the voice services group had been testing voice over IP (VOIP) telephone equipment and was approaching the point of implementing this technology on campus. They were confident enough in it to deploy it to partially satisfy this need (13). At this point, vendor donations of equipment further supplemented the need for equipment in this area (15). The suspension of installation standards and other policies and rules allowed solutions to be put into service at the earliest possible moment (11).

The need to track, organize, and effectively utilize the thousands of volunteers descending on the two sites became an imperative almost immediately after it was opened (3). Attempts were made to assess volunteers for special skills in order to utilize them as effectively as possible (16), but ultimately volunteers were asked to do whatever was needed most at the particular moment (14).

The operations on the campus centered around two functions: the operation of a critical patient care facility and a special needs shelter. The number of evacuees being brought into these two sites was well in excess of planned expectations and no provisions were made for information systems to track patient information as is found in most hospitals. A system was

desperately needed to maintain patient information in these two facilities (4). Initial work focused on whether any existing software systems could be adapted to the task or whether new software would have to be acquired or developed (20).

The efforts made to communicate and coordinate the needs of emergency agencies and campus units was identified as a problem which existed to one degree or another throughout the first week following the hurricane (5). Several technologies were drawn into solving the problem. While cellular systems were saturated from the voice aspect, text messaging was still fairly reliable and was used to mitigate communications problems (18). Reserves of radio equipment were also put into the mix (19).

A final perspective of this group's information points to the fact that while some resources were available on campus to draw from (12), overall the resources available were insufficient to meet the needs of all agencies (10) and the effect of the shortfall was felt in attempts to meet all of the goals mentioned by this group.

3.2.3 Vendor Story

The map for the vendor story is recorded in Figure 2.3. Unusually, the vendor story begins at approximately the same time as the other stories which is before the arrival of evacuees. The reason for this was that the vendor happened to be a resident of the area and had come to the campus to proactively look for ways to contribute. He worked with central IT staff in the collection of available resources for use in the two evacuee sites and observed the early needs for information systems and their associated inadequacies (3) (4) (5).

Significantly, the vendor map differs from the other two in that the vendor experience was centered on a single goal. The goal was expressed in two parts; the ultimate goal and the IT related goal. The ultimate goal was expressed as the need to record the fact that individual human beings were passing through the sites so that families and emergency agencies at

locations further away from the disaster area could track the identity and number of people, where they came from, where they were going, and their condition (1). The IT related goal was to put a distributed information system in place that was easily modified to capture this diverse collection of information and enable its transmission to sites further up the evacuation chain (2) (8). While it was recognized that there was no off the shelf system that could be dropped in (3), the vendor's vast resources, work and experience with other disasters from the larger organizational standpoint, and the sheer desire of the vendor's employees at a grassroots level could be leveraged to augment the efforts on-site and deliver a solution quickly (13) (16) (19). The vendor team quickly adapted work done in the wake of the tsunami disaster to provide the solution (14).

The vendor story includes a sort of postscript in regards to activities that happened after the solution was put in place and the time and resource urgency of the situation began to subside. At that point, contention for the information product of the new system began with agencies arguing for ownership of the information (6), which was exacerbated by the lack of central command and control of the site (21) (23). The influence of the improvised campus command and control structure served as a thin, but clarifying source of control over the sites and processes of the effort (22).

Chapter 4 – Discussion and Implications

4.1 Introduction

As improvisation theory was selected as the best theoretical lens to explain the events at LSU following the hurricanes, the best place to begin the discussion of this research is with an understanding of some of the theory surrounding improvisation. Improvisation has been described as the point where the conception or composition of a solution converges with its execution. One of the major components of improvisation theory discussed by many researchers revolves around systems that describe "types" or "categories" that can be used to describe specific improvisational activities (Moorman and Miner 1998; Wachtendorf 2004).

One of the early improvisation type frameworks was described by Moorman and Miner (1998) using examples from jazz improvisation. Their framework described three types of improvisational behavior. The first type of improvisation they described as an activity where only modest changes were made to a pre-existing process. Embellishment and ornamentation are other words they used to describe this level of improvisation. The next type of improvisation they described as activity where there is a stronger departure from the "referent", or basis of the action being considered. The referent can be any activity that the improviser has immediately at hand to work with; a sequence of musical notes in jazz or a prior experience considered to be similar in some context to the current situation. The third type or level of improvisation involves the migration to, or creation of, a completely new approach or solution devised in the same timeframe that it is required.

> "a member of the UNO information staff … showed up at the information systems office and was looking for a way to get communication with the [students and employees of] UNO reestablished." (reproductive improvisation)

Another system of segregating improvisational activities is based on outcomes as proposed by Wachtendorf (2004). This system categorizes improvisation into reproductive, adaptive, and creative actions. The lowest level is described as *reproductive improvisation*. In reproductive improvisation, the focus is on recreating a capacity that pre-existed and has been lost or destroyed. Improvisation occurs in the means used to accomplish the restoration of the pre-existing service or structure.

> "once things settled down from the initial crisis and school started again, … we needed to work on applications that allowed displaced students who needed to register with LSU. And there was even a late registration service center for displaced hurricane victims." (adaptive improvisation)

The next level in Wachtendorf's system is termed *adaptive improvisation*. At this level an existing solution is modified to meet the requirements of the new situation. Improvisation occurs in the creation of the changes to the existing system.

> "one of the big things that we spent a lot of time on and I had guys in Redmond and Walter, Mass. that work for the Groove Development Office that was doing a whole lot of work for us … in the back end to get that [evacuee] data out, to get that data into Groove so that all that information would be trackable in a central location" (creative improvisation)

The final level of improvisation in this system is called *creative improvisation*. This level of activity entails the creation of a new solution without prior example. The entire activity at this level can be considered part of the improvisation.

This research proposes that the efforts in emergency response following the 2005 hurricanes fall primarily into the areas of adaptive and creative improvisation. Contributions were certainly made to the reproductive improvisation processes undertaken by organizations displaced by the flooding following the hurricanes, but only from the standpoint of consulting input and thus, are excluded from this study.

4.2 "Bricolage" at LSU

A core concept in improvisation is that of "Bricolage", or "making do with the materials at hand" (Moorman 1998). Materials can be anything that could be considered necessary to the solution being considered including tangibles such as computers, enabling commercial software, skilled or unskilled personnel, and customized software systems. The ability of improvisers to use knowledge and memory for improvisation was also discussed by Moorman and Miner (1998). They describe two types of memory and the interplay of those types in the process of improvisation. *Declarative memory* is the term used for the human ability to remember facts or principles. This memory or knowledge is not necessarily attributable to a specific experience, but is simply part of our basic understanding the world around us. The second type of memory is *procedural memory*, or the memory of how things are performed or accomplished. This type of memory is more often associated with experiential knowledge or knowledge of particular process. The true value of these memory types relative to improvisation is dependent on the improviser's ability to use declarative memory to leverage procedural memory in creating solutions to the problems at hand.

> "we have the resources, the school was shut down so we had the labs that had the computers that had the printers that could be used. We had the laptops through the library stock that students could check out now; we used those laptops. The laptops in ITS that weren't being used, we took those laptops. We used any resources we could get our hands on and put it in the PMAC and Field House."

Following the arrival on campus of the first state agencies and before the actual opening of the two facilities, the process of bricolage began as IT personnel began looking for ways to meet the demands for computers, printers, fax, and communications. The technology environment of the University provided a source from which improvisation could begin. A critical factor in leveraging that technology was the knowledge of where on the campus it was

located and who controlled it. Due to the support from all levels of the campus, that knowledge and the permission to leverage those resources were quickly provided.

> "I didn't have the skills to deal with every single situation but I did have access to people who did."
> "Now [vendor] came to the rescue in the PMAC…. They came in and played a sizeable (role)…"

Another component of the bricolage process was finding skilled, experienced personnel to put solutions and infrastructure in place for the emergency agencies. That process involved finding people immediately available to make those solutions happen. Finding skilled personnel was not so much the problem as finding sufficient skilled personnel to meet the crush in demand for IT resources and services. One issue results from the tremendous variety of technology available today. While there were many IT professionals in the Baton Rouge area and many others volunteering from around the country to come into the area, IT is also a very specific skill due to the large variety in hardware and software paradigms. Thus, the utility of an IT professional in a given circumstance is specific to the predominant IT infrastructure in the space where improvisation is occurring.

4.3 Openness to Improvisation

Another influential factor in improvisation that was found in the data was that of organizational openness to the process of improvisation. Prior research discusses an organization's openness to this process. Frequently, procedures are documented and policies may require strict adherence to them. In contrast, one principle of improvisation is that the situation and its characteristics will teach you what you need to know to find a solution if you let it, rather than trying to force one (Crossan 1998). Further, to explore the benefits of improvisation to the fullest, the improviser must maintain an open mind to the real goals in dealing with the situation or problem.

> "what I want you to do is make a wish list. Let's sit down for as long as you have, 20 minutes, 10 minutes, whatever in between patients, and you tell me everything that you need in this facility and I'll do my best to grant that wish"

Openness to improvisation is more of a problem than one might at first suspect. Many organizations, especially those with a narrow focus, find they are unable to break away from long-held approaches to interpreting customer needs and improvise efficiently or even successfully (Weick 1993).

> "But during that first week, it was just me going back and forth between ITS and there and telling - asking what they need, coming back here telling them what they need and then taking [back] the stuff that they needed. So I became the unofficial point person."

Role improvisation was also found evidenced in the data. Role improvisation has also been found to be of value in situations where improvisation and its benefits must be maximized (Crossan 1998; Kamoche, Cunha et al. 2003). Role improvisation lets the mantle of leadership travel dynamically to the person or group most qualified in the process currently at hand. In successive turn, the leadership role moves on to the next individual or group as the focus moves on to the next phase of the process or problem. Due to the lack of central leadership in the first few days following the opening of the facilities, role improvisation in IT was constant during that time as the focus moved from networks, to equipment, to software systems.

4.4 Timing in Improvisation

> "there was no central authority in place for them to authenticate to so everybody had to know a local I.D. and password on each machine. Hind sight looking back, had we known where this was going to go, we would have put a little bit of structure in place around it but at the time, everybody was just trying to respond [and] put out fires."

The importance of timing in improvisation or knowing when and when not to improvise is an important component in successfully mitigating a problem (Mendonca 2007). The perceived risks and rewards are the deciding factors for the improviser. Will the improvised solution work and what will failure cost? And if it works, what will we gain? These are a few of

the questions influencing the decision to improvise. As the number of evacuees pouring in to the PMAC and Field House multiplied, the plans for accommodating them quickly became invalid and new plans had to be drawn up and implemented.

> "the strategic national stockpile from the federal government had come in and brought just an endless supply of goods over to the PMAC, but would not share any of that with the Special Needs Shelter because the agreement was with Health and Hospitals, not Social Services. It was the most ridiculous contractual nightmare I have ever witnessed. So, eventually, we just commandeered those things "

> "Well, I had violated about 10,000 rules. I said, that's great, please report me to the state, federal government, whatever you've got to do, thanks, bye. So, you know, I'm dealing with stuff that has no, is of no consequence"

Decisions to override long standing plans and agreements were made and new agreements made as the situation unfolded. Under normal circumstances, these types of actions would be seen as chaos, but in the context of an extreme event they are an essential component for success.

4.5 The Culture of Improvisation

> "we had a puzzle that we needed to put together and we had no box top. So what we needed to do was figure out, what is this picture supposed to look like and what part am I playing, what piece am I and where do I fit. And I feel like that's what happened, and, you know, without people like Ric Simmons and Sean Robbins and John Morello and Brian Voss – oh my God, we'd probably still be there."

> "There wasn't any, 'Hey, I don't want to ask that person because they are going to make more out of it or I'm concerned about that or that's their turf.' There wasn't any turf; there wasn't any… you didn't have time."

Organizational culture may be one of the most influential factors in fostering improvisation during extreme events. The openness of an organization to allowing actors in an extreme event the freedom to improvise may be a deciding factor in the success or failure of the efforts to mitigate that event. In practical terms, this means giving actors the freedom to get involved, the room to make mistakes and learn from them (Crossan 1998). It also means being open to allow actors from outside the organization to get involved in the process of

improvisation. In the course of the Katrina effort, IT workers were given complete latitude and support to address needs as they arose without significant intervention from managers remote to the sites where the work was being done.

4.6 Conclusions

The data collected for this study, taken in its entirety, forms a rich gumbo of experiences. For many of the subjects, their participation in the efforts to mitigate the suffering of tens of thousands of evacuees following Hurricanes Katrina and Rita was one of the most rewarding and personally challenging experiences of their lives. The stories related by the subjects lead to several observations.

The first observation is that the traditional university environment presents a rich environment for "bricolage" in improvising solutions in response to extreme events. The variety and quantities of technologies and skills found on college campuses are relatively unique within most communities. In addition, the presence of significant and capable manpower reserves in the form of students present a resource in emergency response that is not available in many other contexts.

Next, in connection with the leadership aspect of the research, the absence of IT leadership and the successful effort to provide IT in an unprovisioned space may argue that extensively pre-planned leadership organizations may not be necessary. Do natural leadership structures form of their own accord during extreme events? In essence, will leadership improvise itself if the necessary ingredients are present?

Finally, prior research states that improvisation can be enhanced by removing organizational obstacles to creative thinking and by creating an organizational culture that values creativity (Kendra and Wachtendorf 2006). This study speaks to the value of the diverse and open culture of the university environment as a rich setting for mitigation efforts to extreme

events. With a diverse mix of energetic, intelligent students; faculty members trained to think creatively and in the abstract; and industry skilled staff, these organizations are already tasked with the mission to solve the problems of today's society. As such, they come ready-made with a unique and potent set of ingredients that can be used to form an improvisational engine that in turn, can be directed towards extreme events. The research of Kendra (2006) supports this finding as well through the assertion that there is utility in community organizations even in terrorist-attack scenarios and that these organizations may be even be more appropriate in civil contexts.

4.7 Future Research

The opportunities for future research in the context of the 2005 hurricanes that struck Louisiana and Mississippi are too numerous to count. Some of the questions raised in the course of this study are IT related and some are only indirectly related. For example, one question raised by the study was "How significantly does the motivation of the actors influence the success or failure of the actors attempting to improvise solutions following extreme events?" Did the magnitude of the event generate a level of motivation in the public that basically overwhelmed or overran the problem?

Another question raised was, "Does the solution-oriented and improvisational nature of IT work contribute uniquely to success of IT professionals in responding to critical demands?" Is the high-demand, frequently improvisational nature of IT an ongoing dress rehearsal for extreme events?

And finally from a theoretical standpoint, additional research in this area could focus on the effects that the Katrina experience had on the technology organizations on campus as explained by adaptive structuration or social theory. Some artifacts of the Katrina experience discussed in the course of the interviews point to a relationship to certain constructs contained in

those theories, but data elicitation was not directed on those aspects and thus no conclusions can be made.

References

Ackerman, F., C. Eden, et al. (1992). Getting Started with Cognitive Mapping, Phrontis Corporation, Inc.

Alexander, D. E. (2004). "Cognitive Mapping as an Emergency Management Training Exercise." Journal of Contingencies & Crisis Management **12**(4): 150-159.

Axelrod, R. (1976). Structure of Decision: The Cognitive Maps of Political Elites. New Jersey, Princeton University Press.

Baskerville, R., S. Pawlowski, et al. (2000). Enterprise resource planning and organizational knowledge: patterns of convergence and divergence. Proceedings of the twenty first international conference on Information systems. Brisbane, Queensland, Australia, Association for Information Systems.

Bogard, W. C. (1988). "Bringing Social Theory To Hazards Research." Sociological Perspectives **31**(2): 147-168.

Bougon, M., K. Weick, et al. (1977). "Cognition in Organizations: An Analysis of the Utrecht Jazz Orchestra." Administrative Science Quarterly **22**(4): 606.

Cossette, P. and M. Audet (1992). "Mapping of an Idiosyncratic Schema." Journal of Management Studies **29**(3): 325.

Crossan, M. M. (1998). "Improvisation in Action." Organization Science **9**(5): 593-599.

DeSanctis, G. (1994). "Capturing the Complexity in Advanced Technology Use: Adaptive Structuration Theory." Organization Science **5**(2): 121-147.

Donahue, A. and R. Tuohy (2006). "Lessons We Don't Learn: A Study of the Lessons of Disasters, Why We Repeat Them, and How We Can Learn Them." Homeland Security Affairs **II**(2).

Eden, C. (1992). "On the Nature of Cognitive Maps." Journal of Management Studies **29**(3): 261.

Eden, C. (2004). "Analyzing cognitive maps to help structure issues or problems." European Journal of Operational Research **159**(3): 673-686.

Fahey, L. and V. K. Narayanan (1989). "Linking Changes in Revealed Causal Maps and Environmental Change: An Empirical Study." Journal of Management Studies **26**(4): 361.

Fiol, C. M. and A. S. Huff (1992). "Maps for Managers: Where Are We? Where Do We Go From Here?" Journal of Management Studies **29**(3): 267-285.

JPDM. (as of 2007). "Glossary of Terms." Journal of Prehospital and Disaster Medicine Retrieved 1/15/2007, from http://pdm.medicine.wisc.edu/vocab%20new.htm.

Kamoche, K., M. P. e. Cunha, et al. (2003). "Towards a Theory of Organizational Improvisation: Looking Beyond the Jazz Metaphor." Journal of Management Studies **40**(8): 2023-2051.

Kelton, K., D. Mendonca, et al. (2000). Acquiring and Assessing Knowledge From Multiple Experts Using Graphical Representations. Knowledge Based Systems. C. Leondes, Elsevier. **1**.

Kendra, J. M. and T. Wachtendorf (2006). Improvisation, Creativity, and the Art of Emergency Management. Nato Advanced Research Workshop on Understanding and Responding to Terrorism: A Multi-Dimensional Approach. Washington, D.C., University of Delaware.

Laukkanen, M. (1994). "Comparative Cause Mapping of Organizational Cognitions." Organization Science **5**(3): 322-343.

Mendonca, D. (2007). "Decision Support for Improvisation in Response to Extreme Events." Retrieved 12/11/2007, from http://web.njit.edu/~mendonca/papers/xedss.pdf.

Mendonca, D. and W. A. Wallace (2004). "Studying Organizationally-situated Improvisation in Response to Extreme Events." International Journal of Mass Emergencies and Disasters **22**(2): 5-29.

Moorman, C. and A. S. Miner (1998). "Organizational Improvisation and Organizational Memory." Academy of Management Review **23**(4): 698-723.

Pielke, R. and D. Sarewitz. (2000). "Extreme Events: Developing a Research Agenda for the 21st Century." Retrieved 1/15/2007, 2007, from http://www.isse.ucar.edu/extremes/proposal.html.

Roux-Dufort, C. and B. Vidaillet (2003). "The Difficulties of Improvising in a Crisis Situation." International Studies of Management & Organization **33**(1): 86-115.

Wachtendorf, T. (2004). Improvising 9/11: Organizational Improvisation Following the World Trade Center Disaster. Sociology, University of Delaware**:** 268.

Weick, K. E. (1993). "The Collapse of Sensemaking in Organizations: The Mann Gulch Disaster." Administrative Science Quarterly **38**(4): 628-652.

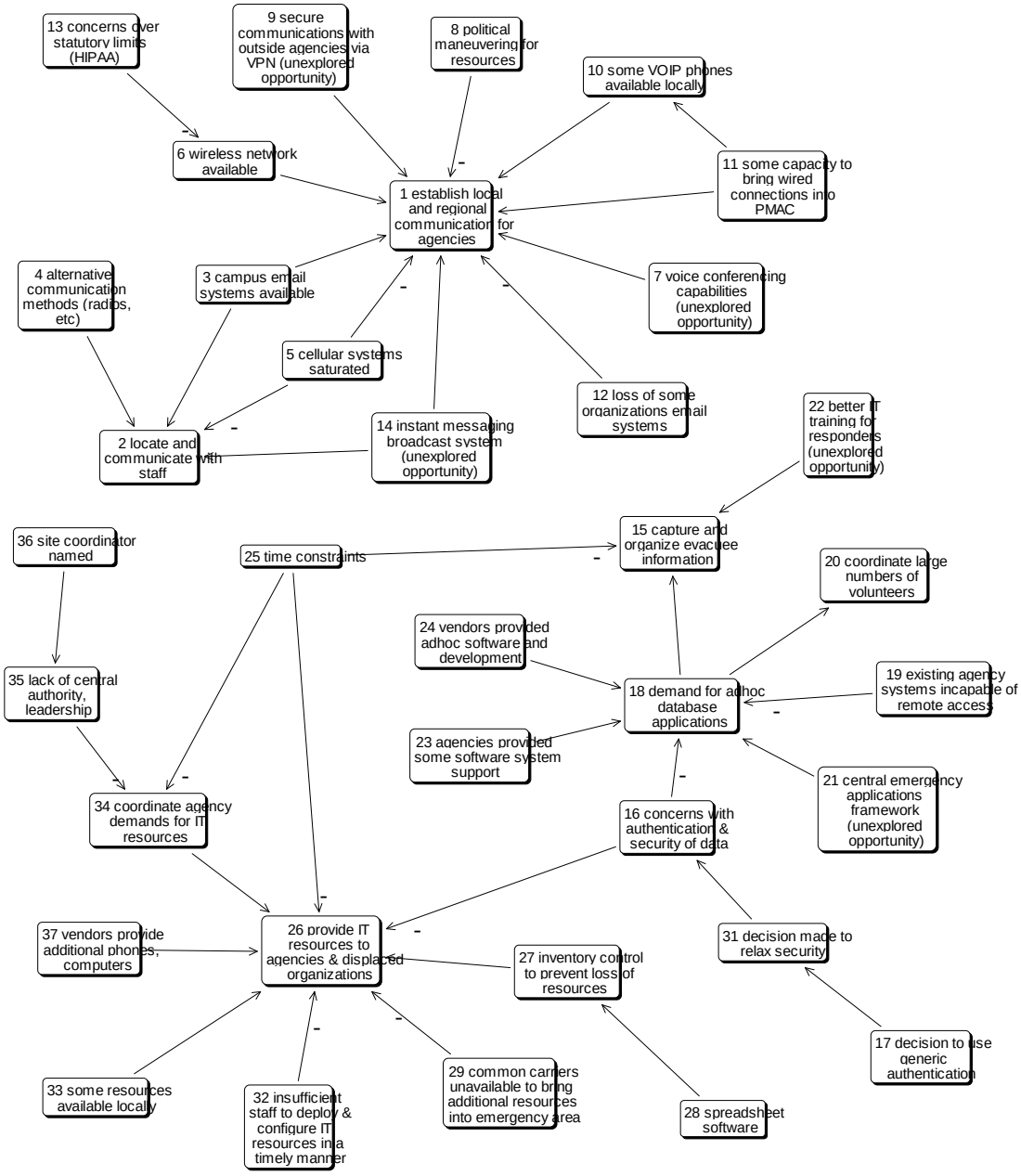
Appendix A – Interview Guide

Interview Guide
(Some questions derived from"Decision Support for Improvisation in Response to Extreme Events" David Mendonca (forthcoming publication))

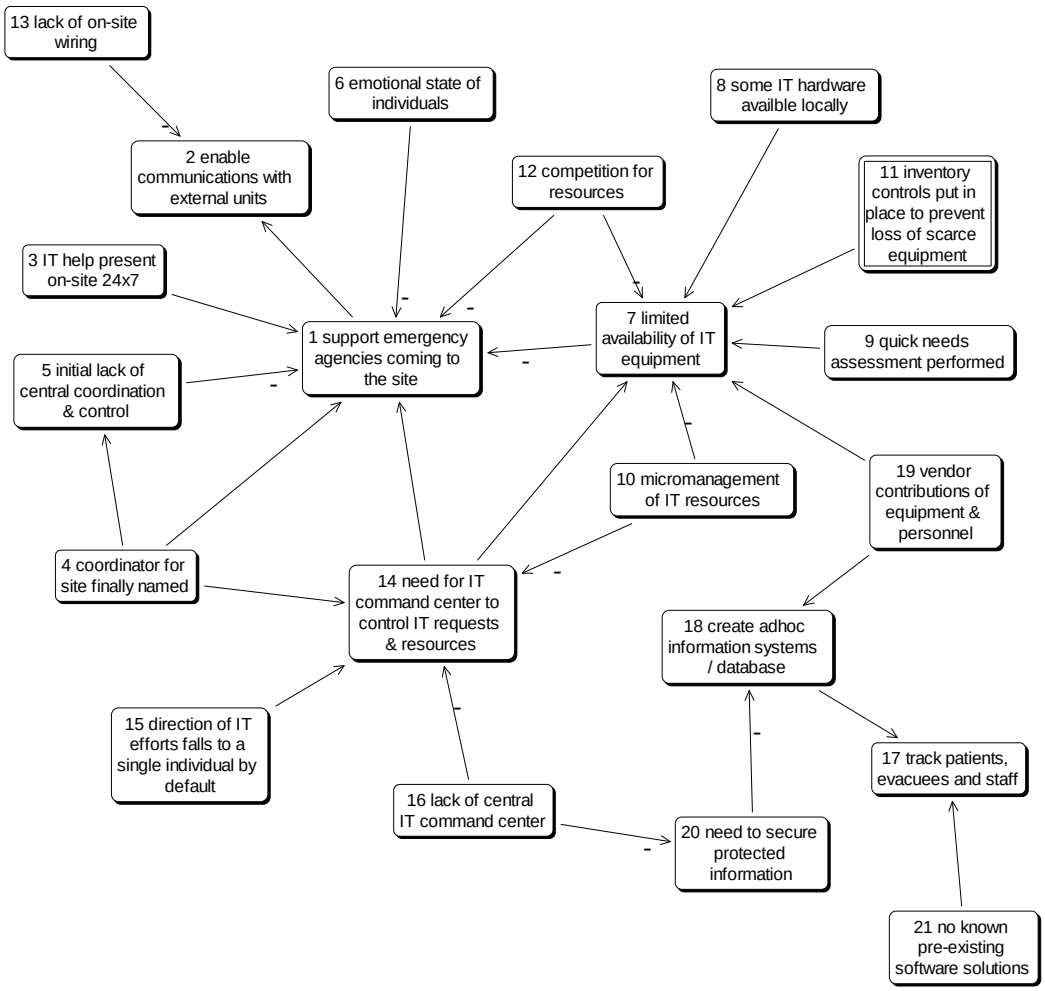
1. During the several week period following Hurricane Katrina, what major issues or challenges were you were involved in finding or implementing solutions for?
2. In which of these issues or problems did you use, or consider using technology as part of a solution or method to address the problem?
3. For each issue or challenge in which technology was used or considered
    a. What were your specific goals or objectives in dealing with this situation?
    b. Were there obstacles to overcome in finding a solution?
    c. What were the technologies and/or strategies chosen to deal with this problem?
    d. What were other options, technologies and/or strategies you considered to deal with this problem? Other courses of action?
    e. Had you ever faced a problem similar to this before?
    f. Was time a factor in dealing with this problem?
    g. What type of training or experience helped you with this problem?
    h. What specific type of training or experience do you think would have been helpful in this situation?
    i. Did any persons or groups assist you in choosing a solution and what roles did they play in the crisis? In the particular problem?

Appendix B – Cognitive Maps

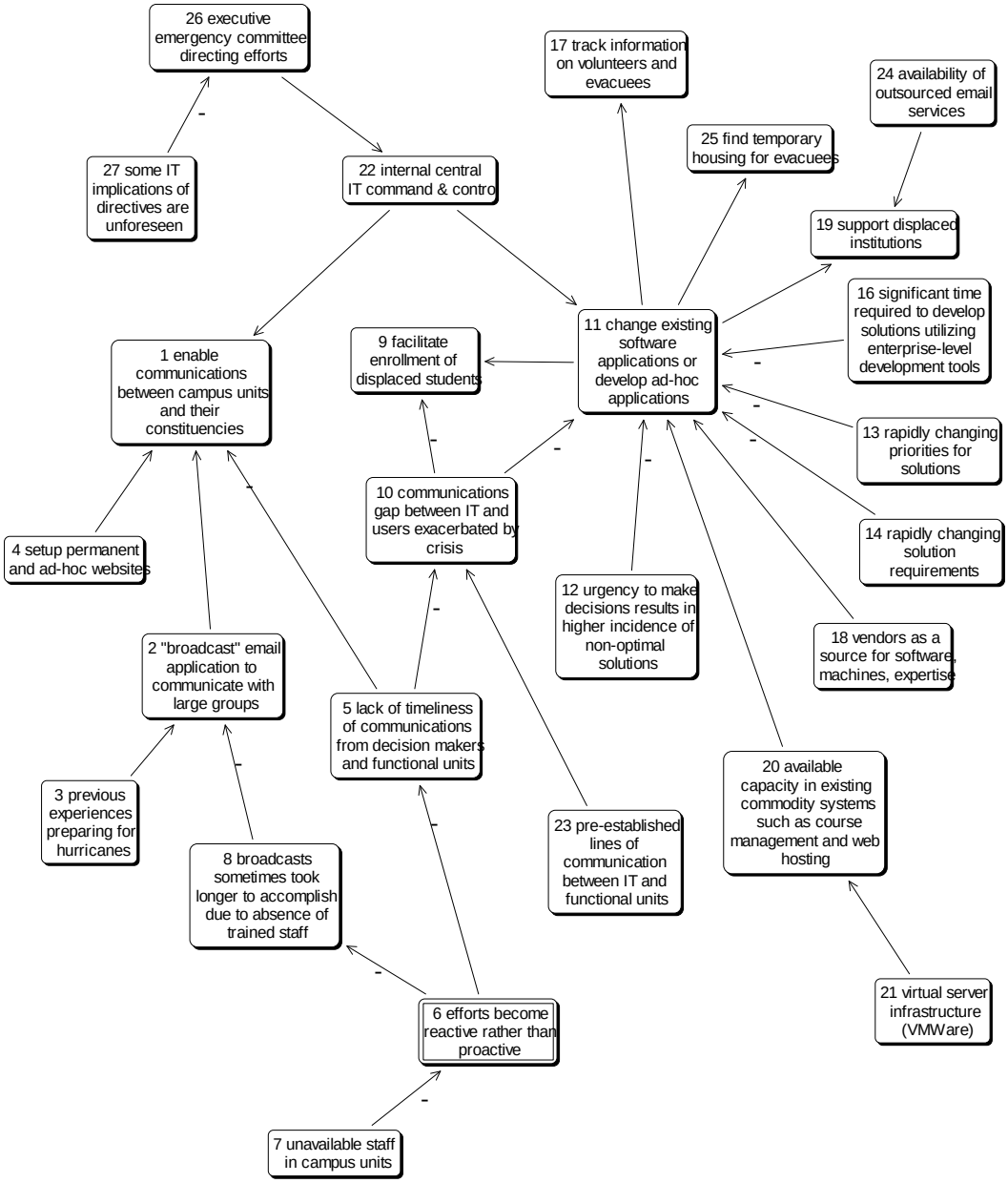
Subject 1


13 concerns over statutory limits (HIPAA)
9 secure communications with outside agencies via VPN (unexplored opportunity)
8 political maneuvering for resources
10 some VOIP phones available locally
6 wireless network available
11 some capacity to bring wired connections into PMAC
1 establish local and regional communication for agencies
4 alternative communication methods (radios, etc)
3 campus email systems available
7 voice conferencing capabilities (unexplored opportunity)
5 cellular systems saturated
12 loss of some organizations email systems
22 better IT training for responders (unexplored opportunity)
2 locate and communicate with staff
14 instant messaging broadcast system (unexplored opportunity)
36 site coordinator named
25 time constraints
15 capture and organize evacuee information
20 coordinate large numbers of volunteers
24 vendors provided adhoc software and development
35 lack of central authority, leadership
18 demand for adhoc database applications
19 existing agency systems incapable of remote access
23 agencies provided some software system support
34 coordinate agency demands for IT resources
21 central emergency applications framework (unexplored opportunity)
16 concerns with authentication & security of data
37 vendors provide additional phones, computers
26 provide IT resources to agencies & displaced organizations
27 inventory control to prevent loss of resources
31 decision made to relax security
17 decision to use generic authentication
33 some resources available locally
32 insufficient staff to deploy & configure IT resources in a timely manner
29 common carriers unavailable to bring additional resources into emergency area
28 spreadsheet software

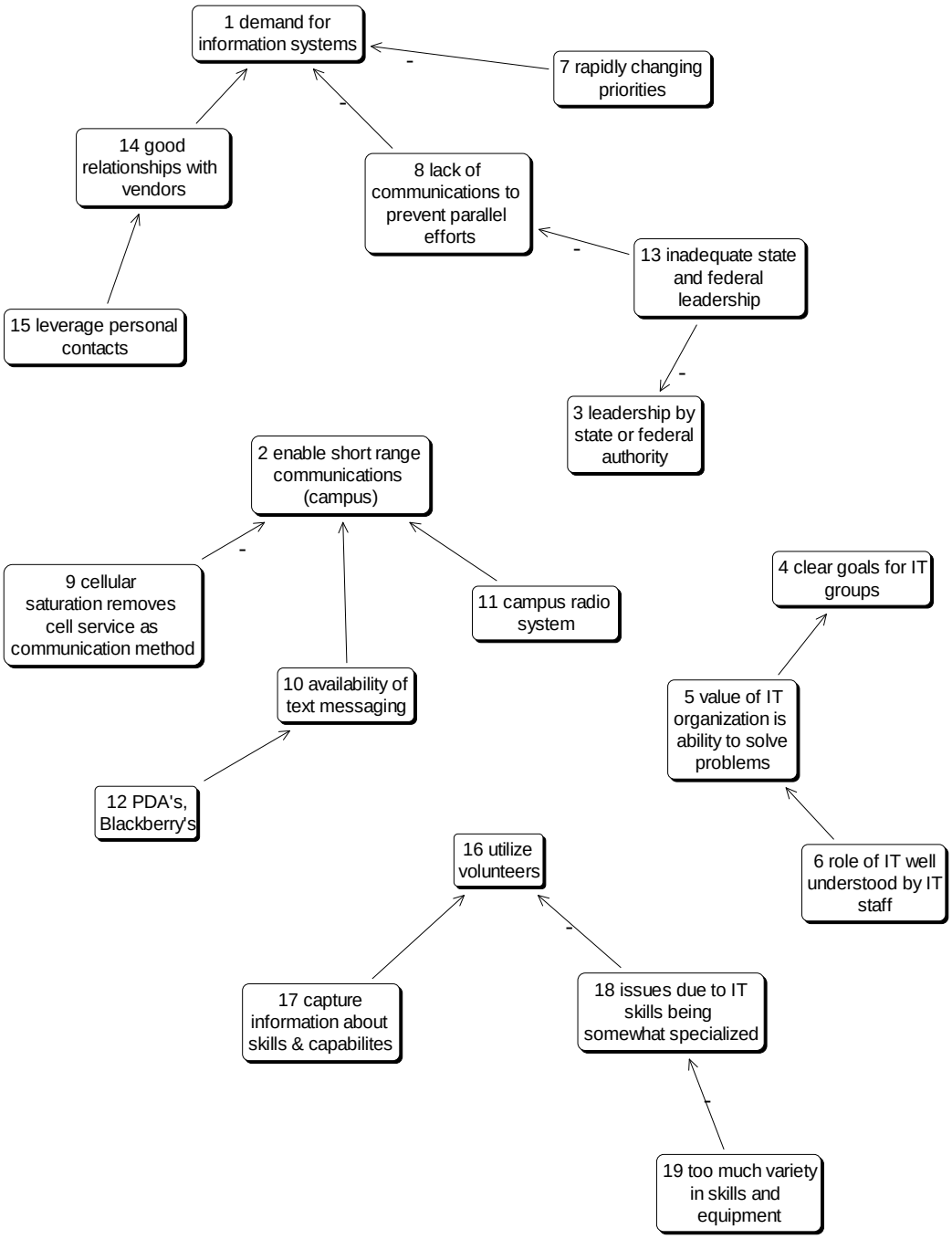
Subject 2


13 lack of on-site wiring
6 emotional state of individuals
8 some IT hardware availble locally
2 enable communications with external units
12 competition for resources
11 inventory controls put in place to prevent loss of scarce equipment
3 IT help present on-site 24x7
1 support emergency agencies coming to the site
7 limited availability of IT equipment
9 quick needs assessment performed
5 initial lack of central coordination & control
10 micromanagement of IT resources
19 vendor contributions of equipment & personnel
4 coordinator for site finally named
14 need for IT command center to control IT requests & resources
18 create adhoc information systems / database
15 direction of IT efforts falls to a single individual by default
16 lack of central IT command center
17 track patients, evacuees and staff
20 need to secure protected information
21 no known pre-existing software solutions

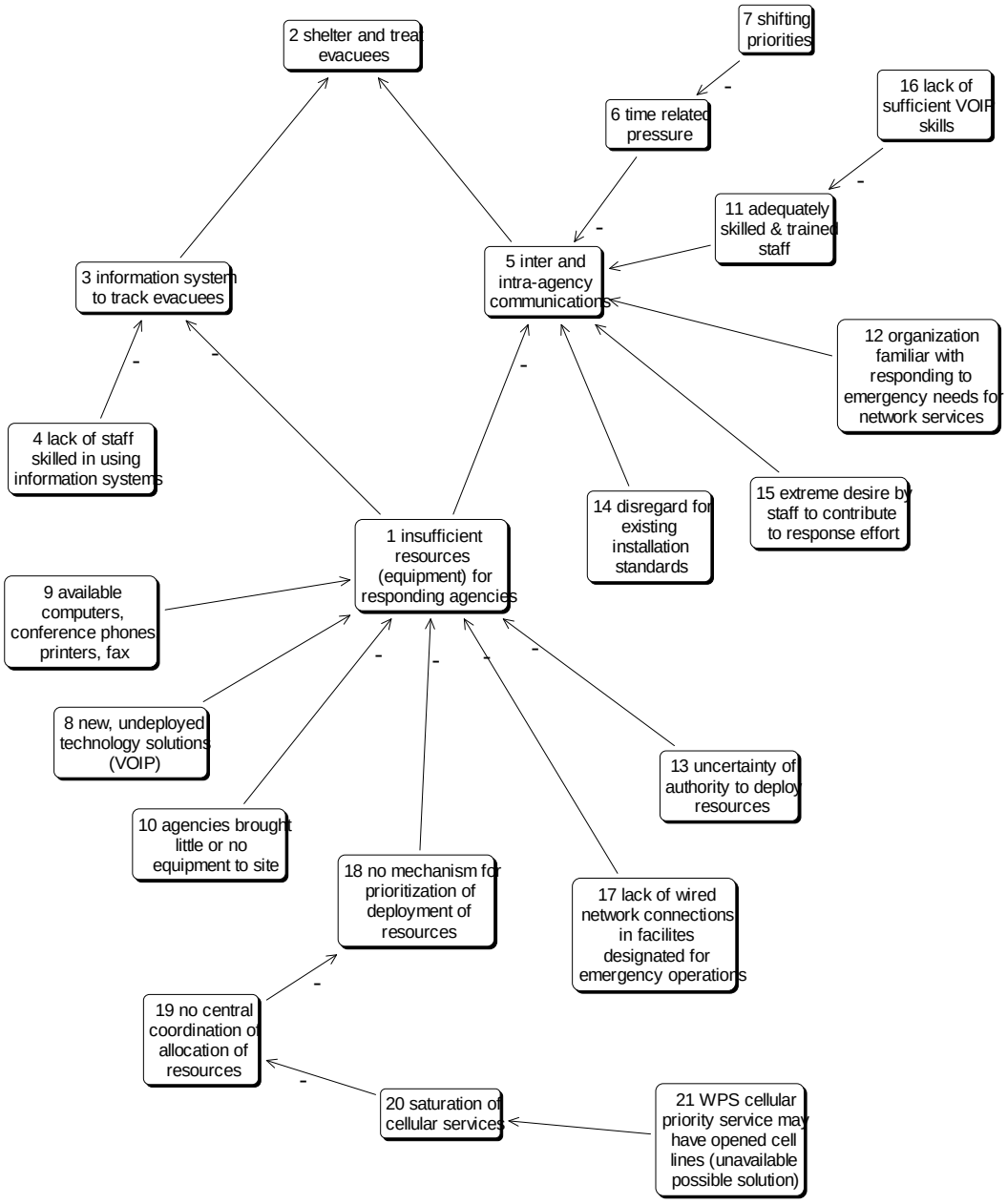
Subject 3


26 executive emergency committee directing efforts
17 track information on volunteers and evacuees
24 availability of outsourced email services
25 find temporary housing for evacuees
27 some IT implications of directives are unforeseen
22 internal central IT command & contro
19 support displaced institutions
16 significant time required to develop solutions utilizing enterprise-level development tools
11 change existing software applications or develop ad-hoc applications
1 enable communications between campus units and their constituencies
9 facilitate enrollment of displaced students
13 rapidly changing priorities for solutions
10 communications gap between IT and users exacerbated by crisis
14 rapidly changing solution requirements
4 setup permanent and ad-hoc websites
12 urgency to make decisions results in higher incidence of non-optimal solutions
18 vendors as a source for software, machines, expertise
2 "broadcast" email application to communicate with large groups
5 lack of timeliness of communications from decision makers and functional units
20 available capacity in existing commodity systems such as course management and web hosting
3 previous experiences preparing for hurricanes
23 pre-established lines of communication between IT and functional units
8 broadcasts sometimes took longer to accomplish due to absence of trained staff
21 virtual server infrastructure (VMWare)
6 efforts become reactive rather than proactive
7 unavailable staff in campus units

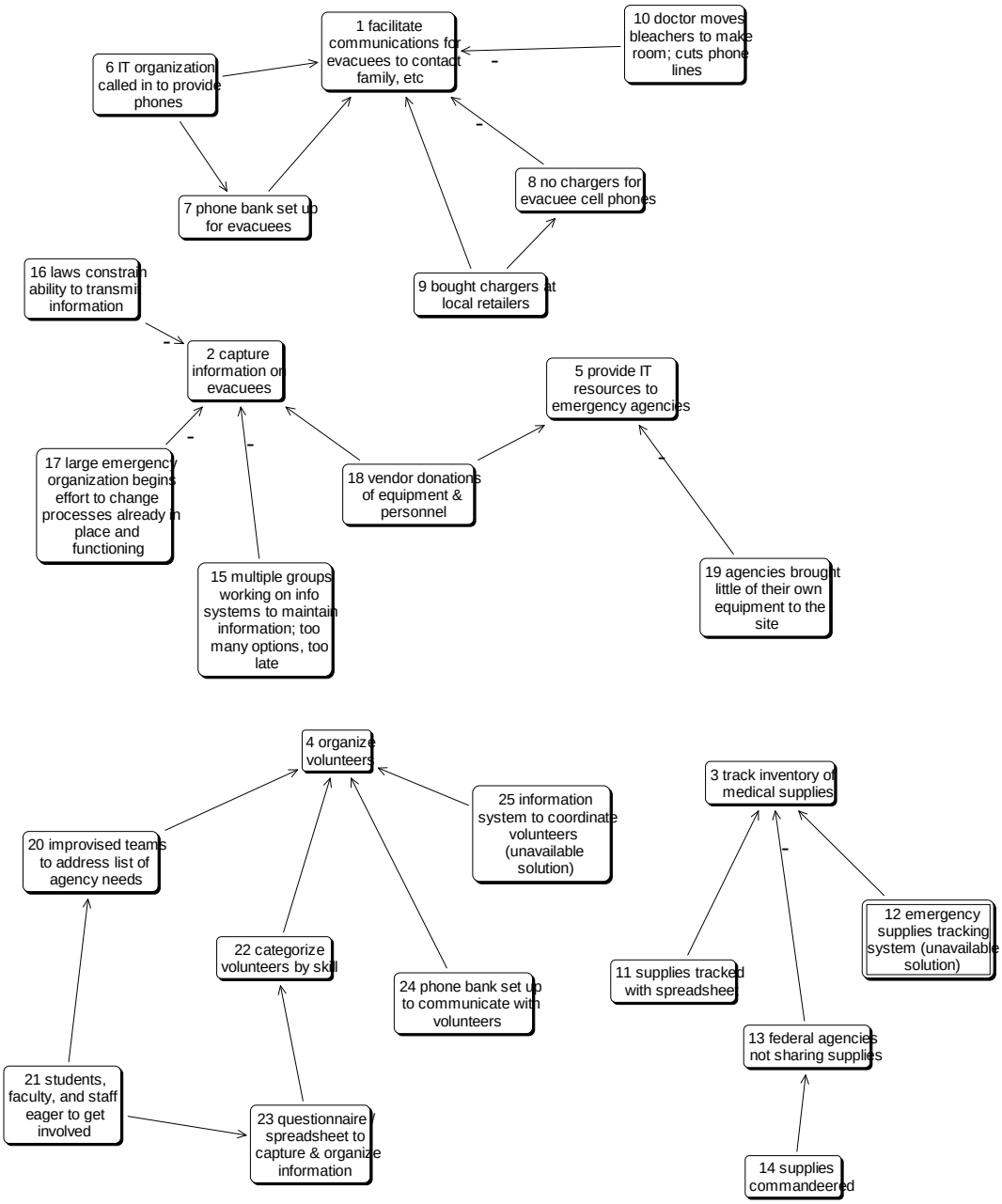
Subject 4


1 demand for information systems
7 rapidly changing priorities
14 good relationships with vendors
8 lack of communications to prevent parallel efforts
13 inadequate state and federal leadership
15 leverage personal contacts
3 leadership by state or federal authority
2 enable short range communications (campus)
9 cellular saturation removes cell service as communication method
11 campus radio system
4 clear goals for IT groups
10 availability of text messaging
5 value of IT organization is ability to solve problems
12 PDA's, Blackberry's
16 utilize volunteers
6 role of IT well understood by IT staff
17 capture information about skills & capabilites
18 issues due to IT skills being somewhat specialized
19 too much variety in skills and equipment

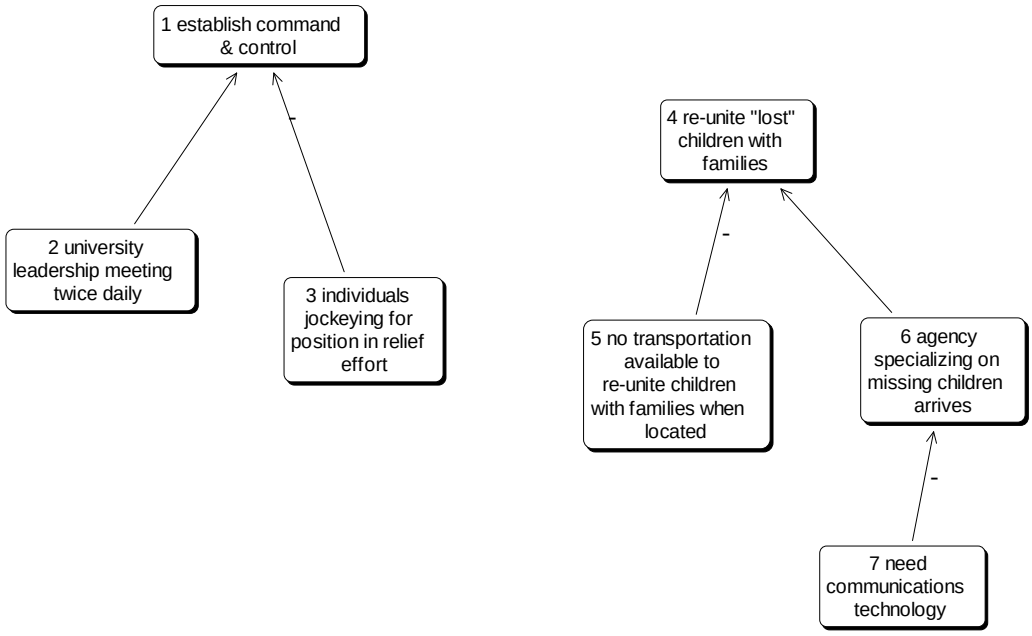
Subject 6


2 shelter and treat evacuees
7 shifting priorities
16 lack of sufficient VOIP skills
6 time related pressure
11 adequately skilled & trained staff
3 information system to track evacuees
5 inter and intra-agency communications
12 organization familiar with responding to emergency needs for network services
4 lack of staff skilled in using information systems
14 disregard for existing installation standards
15 extreme desire by staff to contribute to response effort
1 insufficient resources (equipment) for responding agencies
9 available computers, conference phones printers, fax
8 new, undeployed technology solutions (VOIP)
13 uncertainty of authority to deploy resources
10 agencies brought little or no equipment to site
18 no mechanism for prioritization of deployment of resources
17 lack of wired network connections in facilites designated for emergency operations
19 no central coordination or allocation of resources
20 saturation of cellular services
21 WPS cellular priority service may have opened cell lines (unavailable possible solution)

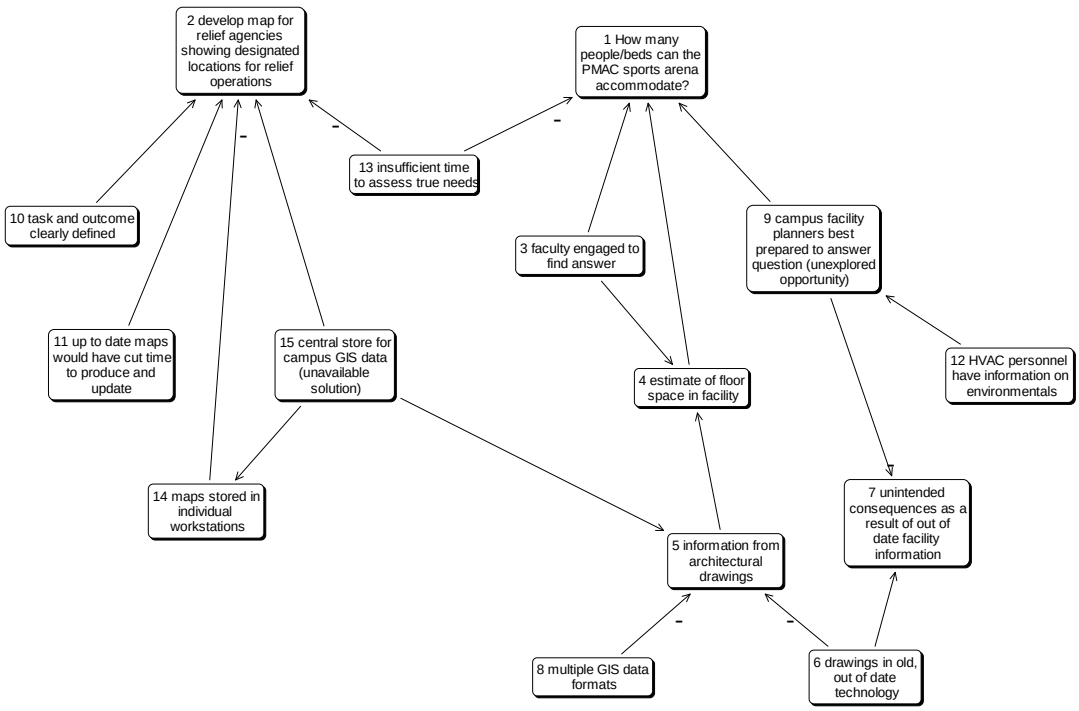
Subject 7


1 facilitate communications for evacuees to contact family, etc
10 doctor moves bleachers to make room; cuts phone lines
6 IT organization called in to provide phones
7 phone bank set up for evacuees
8 no chargers for evacuee cell phones
9 bought chargers at local retailers
16 laws constrain ability to transmit information
2 capture information on evacuees
5 provide IT resources to emergency agencies
17 large emergency organization begins effort to change processes already in place and functioning
18 vendor donations of equipment & personnel
15 multiple groups working on info systems to maintain information; too many options, too late
19 agencies brought little of their own equipment to the site
4 organize volunteers
25 information system to coordinate volunteers (unavailable solution)
3 track inventory of medical supplies
20 improvised teams to address list of agency needs
22 categorize volunteers by skill
24 phone bank set up to communicate with volunteers
12 emergency supplies tracking system (unavailable solution)
11 supplies tracked with spreadshee
13 federal agencies not sharing supplies
21 students, faculty, and staff eager to get involved
23 questionnaire / spreadsheet to capture & organize information
14 supplies commandeered

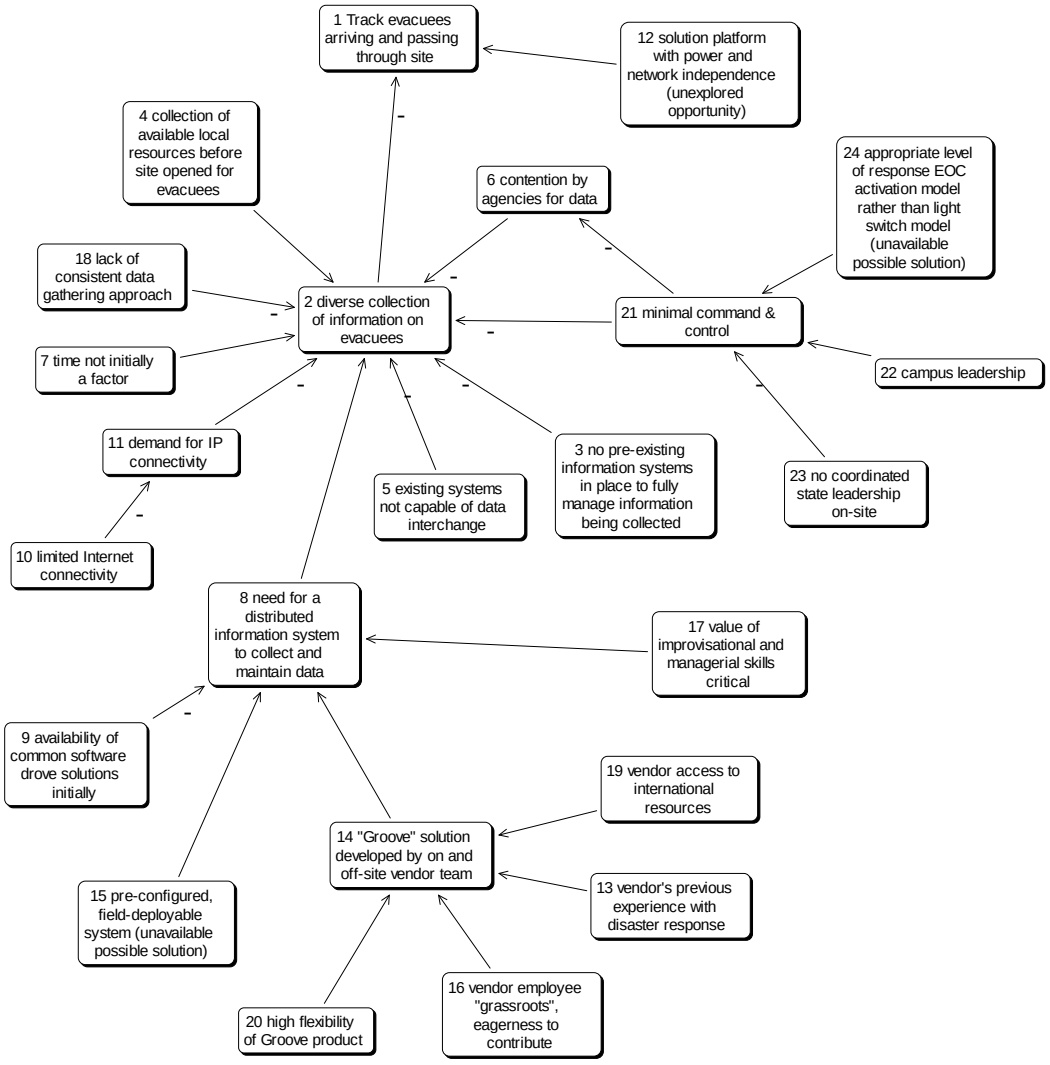
Subject 7-2


1 establish command & control
2 university leadership meeting twice daily
3 individuals jockeying for position in relief effort
4 re-unite "lost" children with families
5 no transportation available to re-unite children with families when located
6 agency specializing on missing children arrives
7 need communications technology

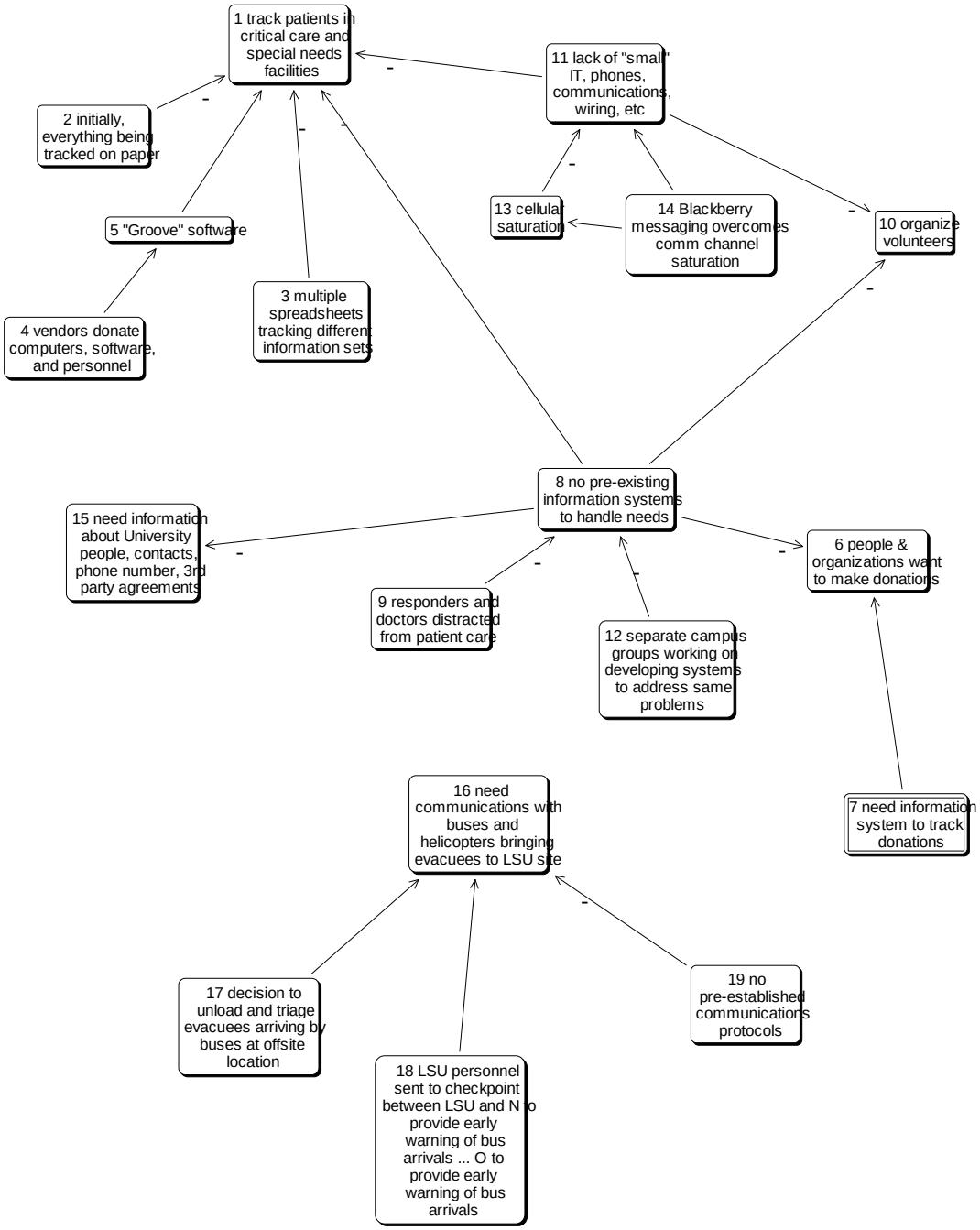
Subject 14


2 develop map for relief agencies showing designated locations for relief operations
1 How many people/beds can the PMAC sports arena accommodate?
13 insufficient time to assess true needs
10 task and outcome clearly defined
3 faculty engaged to find answer
9 campus facility planners best prepared to answer question (unexplored opportunity)
11 up to date maps would have cut time to produce and update
15 central store for campus GIS data (unavailable solution)
4 estimate of floor space in facility
12 HVAC personnel have information on environmentals
14 maps stored in individual workstations
7 unintended consequences as a result of out of date facility information
5 information from architectural drawings
8 multiple GIS data formats
6 drawings in old, out of date technology

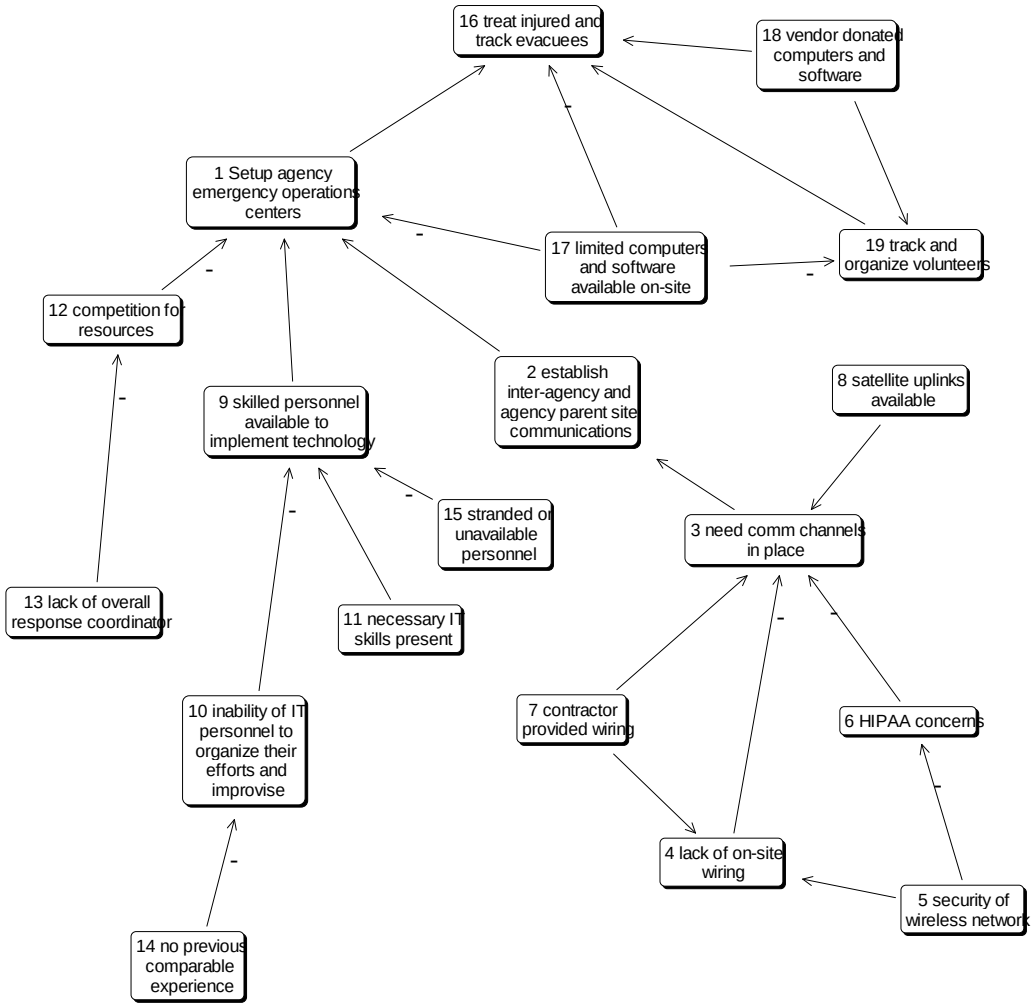
Subject 15


1 Track evacuees arriving and passing through site
12 solution platform with power and network independence (unexplored opportunity)
4 collection of available local resources before site opened for evacuees
6 contention by agencies for data
24 appropriate level of response EOC activation model rather than light switch model (unavailable possible solution)
18 lack of consistent data gathering approach
2 diverse collection of information on evacuees
21 minimal command & control
7 time not initially a factor
22 campus leadership
11 demand for IP connectivity
5 existing systems not capable of data interchange
3 no pre-existing information systems in place to fully manage information being collected
23 no coordinated state leadership on-site
10 limited Internet connectivity
8 need for a distributed information system to collect and maintain data
17 value of improvisational and managerial skills critical
9 availability of common software drove solutions initially
19 vendor access to international resources
14 "Groove" solution developed by on and off-site vendor team
15 pre-configured, field-deployable system (unavailable possible solution)
13 vendor's previous experience with disaster response
20 high flexibility of Groove product
16 vendor employee "grassroots", eagerness to contribute

Subject 17


1 track patients in critical care and special needs facilities
11 lack of "small" IT, phones, communications, wiring, etc
2 initially, everything being tracked on paper
5 "Groove" software
13 cellular saturation
14 Blackberry messaging overcomes comm channel saturation
10 organize volunteers
4 vendors donate computers, software, and personnel
3 multiple spreadsheets tracking different information sets
8 no pre-existing information systems to handle needs
15 need information about University people, contacts, phone number, 3rd party agreements
6 people & organizations want to make donations
9 responders and doctors distracted from patient care
12 separate campus groups working on developing systems to address same problems
16 need communications with buses and helicopters bringing evacuees to LSU site
7 need information system to track donations
17 decision to unload and triage evacuees arriving by buses at offsite location
18 LSU personnel sent to checkpoint between LSU and N to provide early warning of bus arrivals ... O to provide early warning of bus arrivals
19 no pre-established communications protocols

Subject 22


16 treat injured and track evacuees
18 vendor donated computers and software
1 Setup agency emergency operations centers
17 limited computers and software available on-site
19 track and organize volunteers
12 competition for resources
2 establish inter-agency and agency parent site communications
8 satellite uplinks available
9 skilled personnel available to implement technology
15 stranded or unavailable personnel
3 need comm channels in place
13 lack of overall response coordinator
11 necessary IT skills present
10 inability of IT personnel to organize their efforts and improvise
7 contractor provided wiring
6 HIPAA concerns
4 lack of on-site wiring
5 security of wireless networks
14 no previous comparable experience

Vita

John Borne was born in New Orleans, Louisiana, in 1959. He earned a Bachelor of Science degree in computer science from Nicholls State University in 1982. After a short stint with a software firm in Baton Rouge developing clinic management systems, he took a position at Louisiana State University in 1984 with the Technical Services group in the Office of Administrative Information Systems.

In his 23 years employed by LSU, he has worked in a number of IT disciplines including data modeling and administration, database administration, computer programming, server infrastructure specification and management, IT management, and IT architecture. He is currently Director of IS Architecture with the University Information Systems group and serves as advisor to the CIO on new technology initiatives.