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DATA SHARING FOR TASK EFFICIENCY DURING A FOREIGN HUMANITARIAN ASSISTANCE/DISASTER RELIEF EFFORT

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BY

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Dedication

My Heavenly Father

My Family

Parents, Claude and Loraine, who always loved me and believed in me. May they rest in Peace.

My wife, Thunchanok, daughter, Tatum, and son, Toby, for their unwavering love and support.

Acknowledgements

Dr. Aimee L. Franklin, Chair

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George R. Stonesifer, friend, colleague

Colonel (Retired) John Cole, friend, colleague, author

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Abstract:

This paper adapts Zigurs & Buckland's (1998) Task Technology Fit theoretical framework for application to a virtual organization that exists for episodically during foreign humanitarian assistance/disaster relief efforts. Using the 2004 Indian Ocean tsunami, the 2010 Haiti earthquake, and more than 1000 lessons learned cases from the federal government, I examine how task activities, process support level, military command level and partner types influence the technology platform that is used for structured and unstructured data sharing in real time. The predicted fit between task and technology is supported; however, addition of consideration of the virtual nature of the internal and external partnerships that are required for foreign disaster relief efforts improves the explanatory model. Recommendations for theory changes and the practical implications of this research for future foreign disaster relief efforts are explored.

CHAPTER ONE

INTRODUCTION

In a humanitarian assistance/disaster relief (HA/DR) response to a natural or man-made disaster, information is critical to anyone who, or any organization that, has to determine, plan and execute courses of action. Add to this the fact that these types of operations involve many diverse organizations that must work together towards a common goal of providing relief, the sharing and exchange of information becomes a priority for a successful, coordinated operation. The international aspect in foreign disaster relief efforts creates another layer of complexity regarding the nature of data that will be shared by the U.S. military with national and international partners.

This research explores the following question: "In international HA/DR efforts, what kinds of information are shared with and between diverse partners and the U.S. military?" Through empirical analysis, I seek to understand the extent to which different tasks influence the utilization of different technology formats. Is there a reliance on data that are unstructured, such as that found in social media? Or, does the U.S. military prefer to share more traditional structured data, such as lists and databases? The type of data that are shared in unplanned emergencies can influence the success of the collaboration necessary for the planning and execution of a disaster relief operation by many diverse organizations working together toward a common goal of humanitarian assistance.

Background on Humanitarian Assistance/Disaster Relief Efforts

Disasters can be natural or man-made. Examples of natural disasters would include hurricanes, cyclones, mudslides, wild fires, tsunamis, earthquakes, volcanoes, and so on. These occur around the world, many times with little warning. These disasters vary in magnitude from simple property damage to extensive property damage and loss of lives. Sometimes disasters are so devastating that countries have to reach out to other countries for assistance. Time is critical for all relief efforts and so is the coordination and collaboration among all the organizations and people from around the world who participate. Information sharing across a variety of technology platforms is paramount to achieving this goal.

The primary job of the U.S. military is not responding to domestic or foreign disaster events. The primary job of the U.S. military is national defense. It is only on occasion that the U.S. military will be asked to assist in an HA/DR operation. The reason for an assistance request from a foreign country is typically because units of the U.S. military are stationed around the world. Further the U.S. military has the ability to re-act quickly and has the resources to jump start a disaster relief operation. In anticipation of these kinds of assistance requests, the U.S. military conducts many disaster response scenario training exercises each year around the world. The geographic location of the training exercise defines the type of disaster upon which the training exercise will focus, the military personnel and equipment which will be involved, and the local partners, military and non-military, invited to participate in the training exercise.

Even though the U.S. military is the organization that is asked for assistance, the lead federal agency for any disaster response effort in which federal organizations will play a role is the U.S. Department of State. This organization works closely with United States Agency for International Development (USAID) to coordinate the response of multiple federal organizations. The U.S. military has high visibility in these types of operations. Foreign disaster response efforts are good public relations for the United States, U.S. government organizations, and the U.S. military. It is also very rewarding to U.S. military personnel to provide this type of support, to save lives and provide relief to those affected by a disaster.

There are two distinct types of HA/DR responses in which the U.S. military can be involved: domestic and international. Domestic Humanitarian Assistance/Disaster Relief refers to a response by United States-based organizations in response to disasters that occur within the fifty United States (primarily a National Guard responsibility). For domestic natural or man-made disaster events, there are established processes, procedures, and resources at the local, state and national levels. Generally, the resources drawn from multiple levels of government are sufficient for the disaster response and requests for assistance from other countries are not usually made. For this reason, I have limited my analysis to foreign HA/DR events since these are emergency disaster situations where another country, or countries, have asked for assistance from the U.S. military since the disaster response efforts will require resources that exceed the country's capacity.

When requests for the U.S. military to be involved in foreign HA/DR events are received, the procedures for deciding if the U.S. military will be involved and to what extent, is well defined; however, there is no way to anticipate in advance of a disaster with whom the U.S. military will be partnering. Further, there are differences in levels of resources and disaster planning and training for countries around the world. This means that the responses for some HA/DR events will benefit from joint planning exercises that had previously been conducted with the U.S. military, while other countries will not be as familiar with the different command levels and the nuances in expectations for what will be provided by each level and at what phase in the disaster response. Further, there could be a lack of knowledge of preferred strategic, tactical and operational processes embedded in the military's scenario training exercises. The individual and joint influence of all of these factors for HA/DR events is a topic that has not received any attention in scholarly literature.

Theoretical Framework

As described above, in foreign humanitarian assistance/disaster response efforts, the U.S. military is likely to have conducted training exercises to practice responses for common tasks necessary in different phases of a multiplicity of disaster events. As part of the scenario based military exercises, protocols for data sharing across different technological platforms have been developed. Based on the presence of predictable routine tasks in a HA/DR event, which are similar to routine tasks in corporations, this research uses the theoretical lens of task-technology fit (TTF) theory (Zigurs and Buckland, 1998) for analyzing how the U.S. military shares data with a wide variety of partners in an international HA/DR response.

Task technology fit theory suggests that there are five generic types of tasks performed in an organization. These five tasks as considered along three technological dimensions. The theory predicts that information technology can improve individual, and thus organizational, performance (Goodhue and Thompson, 1995). These findings were extended in 1998, to examine group performance rather than individual performance. Testing the revised theory, the results demonstrated similar increases in performance when tasks and technology are aligned Zigurs and Buckland, (1998). This extension of TTF theory to group performance can be considered to be analogous to the U.S. military disaster response since multiple actors with a variety of task responsibilities but a single event and outcome focus are present.

Assuring that the right information is available to all members of a group at the right time is an important conclusion from TTF theory. This conclusion can be extrapolated to foreign disaster responses that are successfully accomplished by gathering, aggregating, evaluating and structuring both structured and unstructured data. Achieve this in a foreign disaster response is a difficult and complex activity since physical infrastructure may have been destroyed or will not be reliable. Further, HA/DR is not a unitary task since it is an open network of collaborators representing government, for profit and non-governmental organizations from many countries, yet the specific who cannot be identified prior to the disaster. This operational context translates to a situation featuring many different partners contributing and/or accessing data throughout all the disaster response tasks.

In this dissertation, I modify the task-technology framework to test its transferability to a governmental setting, and in particular, one that simultaneously feature routine and predictable tasks activities that have to be modified based on an unplanned disaster context. The focus of this analysis is solution scheme multiplicity (Zigurs and Buckland, 1998, p. 317) and the choice of the communication technologies. Further, the concept of a group is extended to a virtual group of partners representing organizations that are external to the U.S. military organizations. In addition to deductively testing the two variables (task and technology) in the model proposed by Zigurs and Buckland (1998), I inductively analyze three other variables (process level, military command and the kinds of partners) that my personal experiences suggest could be additional or stronger predictors of the choice of data types hosted in different technology platforms to be shared between the U.S. military and ad hoc disaster relief partners.

Using case studies of two high visibility foreign HA/DR operations, both of which involved the United States military playing a major role in the provision of disaster relief, this dissertation examines factors that might influence information sharing choices during the relief efforts. The results from the case studies are compared to more than 1,000 lessons learned cases developed for, and maintained by, the U.S. federal government to systematically analyze military and non-military activities to improve future disaster relief response operations.

Case #1: Indian Ocean Tsunami of 2004

One of the most devastating disasters in our life time was the Indian Ocean Tsunami of 2004, which was centered off the coast of Indonesia but had devastating affects throughout the entire region and even as far away as the African continent. The death toll would eventually reach nearly a quarter million people. A massive 9.0 magnitude earthquake off the coast of Sumatra, Indonesia, had generated a huge tsunami that affected not only the immediate area in a matter of minutes but also had effects across the entire region, traveling at over 500 miles an hour and affecting countries across three continents.

For this relief effort, the Combined Support Force 536 was established and was made up of militaries from 15 countries from the region and around the world, along with both governmental and non-governmental relief agencies as well as regional and international organizations (Dorsett 2005). These many and varied organizations were all part of a combined support force to provide assistance and relief to those who were affected. The disaster and the relief effort that followed is of great interest not only because of the magnitude of the disaster, the huge geographic expanse, and the amount of human suffering, but also because of the worldwide response. This was a real-world event that would validate the need for information sharing across a wide range of organizations and would shape how countries responded in subsequent disasters. The U.S. military's Pacific Command's Asia-Pacific Area Network (APAN) was one of the primary sources for information sharing in the disaster response. The network facilitated the coordination and collaboration among all non-traditional security partners who were key to the success of this enormous international relief effort. The centrality of the network is important to note because the APAN network would also be used for the same purpose after the Haiti earthquake five years later and a half a world away.

Case #2: Haiti Earthquake in 2010

The second case to be examined is one of the most notable examples of humanitarian assistance/disaster relief events requiring information sharing to achieve an efficient and coordinated response in a multinational disaster relief effort. This is the 7.0 magnitude earthquake which rocked the island nation of Haiti in January 2010. The loss of life and property was significant but limited to one country and the devastating effects were immediately known. Both of these events, the Indian Ocean tsunami in 2004 and the Haiti earthquake in 2010, were similar in many other ways. In both events, humanitarian assistance and disaster relief was required by the affected country. Both cases involved a natural disaster of an earthquake that was started without warning. Also, in both events, the responders were non-governmental organizations; federal agencies from around the world; militaries with specialized equipment, manpower and resources, civil authorities; and local organizations.

Comparative Cases: Joint Lessons Learned Data Base

The Joint Lessons Learned Information System (JLLIS) is a knowledge management system designed to allow federal government stakeholders to document observations and described best practices identified as valuable information that provides lessons learned from crisis and steady state operations, events, and exercises. The lessons learned in the database often serve as the basis to bolster, and in some cases, establish capability requirements when the analysis suggests capability gaps. The title "Joint Lessons Learned Information System" suggests that it is available to only the various joint organizations and combatant commands, when it in fact includes lessons learned from all service commands and component commands - essentially all military organizations. Another factor that makes JLLIS a valuable resource is that it also includes entries by interagency organizations that interface with the military as well. Even though this system is primarily for military and government organizations, many of the contributions include working with external and international partners.

Chapter Summary

The pace of natural and man-made disasters seems to be accelerating. Combined with this, the magnitude of the disaster often exceeds a single country's resources for responding to a disaster. Requests for the assistance of the United States government, and in particular the U.S. military, are not unusual. In anticipation of these requests, the U.S. military conducts training exercises (alone and with international partners) for responding to a wide variety of disaster scenarios. The training reflects the reality that, when disaster strikes, the U.S. military will be partnering with a wide variety of national and international organizations during the various phases of a disaster response for a collaborative Humanitarian Disaster/Disaster Relief response.

Using two HA/DR cases that involved the U.S. military combined with over 1000 federal lessons learned cases with topics related to information sharing, this dissertation extends Zigurs and Buckland's (1998) task and technology fit theory to the context of data sharing technology platforms that are used for foreign disaster response tasks the U.S. military performs, often in collaboration with internal and external partners. Three types of data are considered: structured, unstructured, and mixed. Structured data is defined as data that is organized in a pre-defined manner, much like databases and spreadsheets. By comparison, unstructured data are data that are not organized in a pre-defined manner, but rather lend themselves to free form technologies such as social media. Mixed is used to describe information that is shared simultaneously through the sharing of both structured and unstructured data. The reason for examining the type of data and technology platforms to be used for information sharing during foreign humanitarian assistance and disaster relief efforts is that the U.S. military tends to prefer a structured data approach for sharing information since it offers more control in real time. Yet, for the multiple members of a HA/DR group (some of whom are familiar to the U.S. military and many others who are not) to function as a cohesive unit, there are moments when unstructured data are needed to complement the sharing of structured data. Determining the best way to make information available to those who need it and how to coordinate communications during different response phases is critical to the overall success of the disaster relief efforts.

This research examines the unique collaborations during episodic and contextually nuanced HA/DR events as they relate to prescriptions drawn from the literature about task-technology fit. Three questions guide the analysis. The first two questions are answered through deductive inquiry. The last question explores the robustness of my adaptation of Task Technology Fit theory through an inductive analysis of four competing independent variables.

Research Question #1: What are the types of data shared by the U.S. military in HA/DR events?

Research Question #2: What is the relative fit between the Task variable and the types of data shared by the U.S. military in HA/DR events?

Research Question #3: Are there other factors, such as Process Support Level, Military Command and/or Partners, that provide a more robust explanation of the types of data shared during the activities of the U.S. military in HA/DR events?

The dependent variable underlying each of the research questions is the type of data being shared. The independent variables that are examined are: (disaster response) phase, process support level, military command, and partners. In addition, there is a single control variable to differentiate between each of the two case studies and the JLLIS lessons learned cases. Combined, these variables address the five W's, who, what, when, where and why.

Who refers to the Partner variable: The partners with whom the U.S. military shares information.

What refers to the Military Command: The command function tasked with supporting different tasks during the relief operation.

When is used to describe the Phase: The tasks normally performed during each of six phases of the relief operation including pre and post-activities.

Where is the institutional location of the Partners: The internal (traditional) and external (non-traditional) organizations with whom the U.S. military partners in each specific HA/DR case.

Why described the Process Support Level: The type of support, strategic, tactical or operational, that guides specific foreign disaster relief responses provided by the U.S. military.

The next chapter provides a description of the U.S. military and the nature of their involvement in foreign humanitarian assistance/disaster relief efforts. In addition, scholarly literature that provides the theoretical framework related to task and technology fit (TTF) is reviewed. The chapter also elaborates the manner in which the TTF theoretical framework is adapted for application to the tasks and data sharing technologies the U.S. military has used and codified governing how it will conduct humanitarian assistance/disaster relief missions.

CHAPTER TWO

LITERATURE REVIEW

The research focus for this study is on the fit between the task and the use of technology for communication between multiple and diverse partners in foreign humanitarian assistance/disaster response (HA/DR) efforts by the U.S. military. Effectively communicating in a natural disaster is challenging because the data must be provided in a way that allows for integration from multiple sources and fosters transparency and accessibility. In addition, since the location and nature of the disaster are different in every situation, the types of partners who are involved in the response vary greatly. This research examines the sharing of data across different kinds of tasks in a context featuring situation-specific collaborations necessary for unpredictable HA/DR events using an adapted task-technology fit theoretical framework.

The first section of this chapter describes typical tasks and data sharing technology platforms used by the U.S. military in foreign HA/DR activities. Following that description, the second section elaborates the characteristics of four specific factors that may influence the data sharing technology choices of the U.S. military during a foreign disaster response. In the third section, the theoretical framework guiding the analysis are introduced. This is followed by a discussion of how the theory is adapted to apply to the U.S. military HA/DR response efforts in the fourth section. The final section of this chapter re-states the research questions and presents the expectations for the empirical analysis.

The U.S. Military Role in HA/DR Events

In many countries, non-governmental organizations (NGOs), International Organizations (IOs), and other groups structure their on-going operations and have resources readily available to provide assistance to vulnerable communities around the world. Many times, these organizations are already in place in the geographic areas impacted by natural and man-made disasters. Whether or not in the geographical area of the disaster, these organizations are usually the first with "boots on the ground" immediately following a disaster. For this reason, the organizations play a very valuable role in providing the initial relief response, especially in countries that do not have slack resources available for disaster relief efforts. These resources include medical supplies, food, shelter, and manpower resources. Military resources may also be necessary for transporting people, equipment and supplies to the disaster ravaged area. In addition, military members from the impacted country and from other countries often provide public safety and security services until civil order is restored.

In a complex foreign humanitarian assistance relief effort, there are many players involved. There are relief agencies, non-governmental and international organizations, in-country and foreign government organization, and possibly foreign and domestic militaries. Each of these organizational entities offer unique and some not so unique specialties and can play a diversity of roles in the disaster response. These organizations have information that could be valuable to all the other organizations, allowing for the leveraging of unique capabilities and strengths. Efficiency in data sharing and collaborative relief response efforts are so critical in a coordinated relief effort. Achieving could be as simple as sharing data on hospital capacity in an affected area, providing satellite imagery or information on supply routes to create a shared operational picture, etc.

Information that is to be shared will differ based on partner capabilities and the intended level of use. For example, if an organization is addressing first responder needs, some of the information they might share would be considered at the tactical level, such as a readily available low-band width technology solution such as a tweet or text message, providing location and details of the real time situation. While other organizations may be involved only at the operational level where number of pallets of water, medical supplies, bridges and supply route conditions, infrastructure needs, air field and port capabilities, hospital capabilities and the like would be their focus. This information will allow responders to execute the operation so that the necessary transportation and/or delivery systems can be provided in order to get these resources to where they are needed. Generic planning for the disaster response tasks and identification of information that can be shared, how it will be shared and with whom, in advance of a disaster is illustrative of data sharing considerations at the strategic level.

It is important to understand processes behind how information is shared and how coordination is conducted between disparate organizations who are thrown together by a disaster. The context of the situation where the disaster has occurred establishes the required activities for the response, which then drives the solutions that can be offered by the various partner organizations engaged in the disaster response effort. To make this process happen in the sequence that is necessary, information sharing plays a big part and therefore, communications systems that can be adapted for operations outside the U.S. military domains are vital.

The United Nations High Commission (UNHCR) for Refugees understands the importance of information sharing. They have a handbook entitled: “A UNHCR Handbook for the Military on Humanitarian Operations.” This handbook addresses the importance of sharing information with the military (UNHCR, 1995). The U.S. Department of Defense also values information sharing as confirmed by a publication entitled the Department of Defense Information Sharing Implementation Plan (DOD, 2016) that “identifies tasks to drive cultural transformation as needed to better promote the practice of information sharing” (p. ii). The importance of pre-established data sharing protocols is suggested by the first case study, the

Indian Ocean Tsunami Relief Effort in 2004 (called OPERATION UNIFIED ASSISTANCE). Recall that I mentioned in Chapter one that there were 15 foreign militaries that participated in the relief effort, along with all the non-governmental organizations, international organizations, local and regional groups and ad hoc groups of residents.

The technology used to exchange information and accomplish disaster relief tasks in a collaborative environment can vary. The information can be shared in numerous ways such as spreadsheets, lists, databases, and files with delimited data. Various technology platforms, such as database management systems, spreadsheet applications, and document management systems are used to support these means of capturing, organizing and exchanging data. There are other technologies and technology platforms that support the sharing of data that is more unstructured such as blogs, wikis, forums, discussion boards, chat rooms, and other forms related to other technologies that support user-generated content, sometimes described as Web 2.0 technologies. There are a variety of factors identified in the literature and drawn from the author's experience as a U.S. military member and participant in the two HA/DR events that constitute the cases in this research. Four of these factors are introduced in the next section.

Factors that Influence Data Sharing Technology

Based on experiences gleaned from historical disaster responses, training exercises and planning for future disaster responses, the U.S. military has already identified and documented important factors that can increase the likelihood of a successful HA/DR response. Four factors thought to be critical to foreign disaster reliefs efforts: Phases, Support Level, Military Command and Partners are reviewed next.

Phases

There are six phases outlined in the *United States Pacific Command Foreign Humanitarian Operations Concept of Operations* (2014, p. 19). Details from this document regarding the tasks and activities that should occur in each phase are provided below:

- Phase 0 – Prepare. The military refers to this phase as shaping the environment. Denoted as Phase 0, these are activities that are not specific to a disaster that has already occurred. Instead they are in preparation for different kinds of disasters that can be expected to occur in the foreseeable future. Preparation for a response, but a currently unknown, crisis is accomplished through participating in collaborative endeavors such as conferences, training and exercises with other regional partners. Through these activities, regional security cooperation is enhanced which increases the capacity to respond in this type of environment. Identifying what type of information is shared and how to share that information during this phase is critical to the success of the subsequent phases.
- Phase I – Assess. This phase is characterized by formalized crisis assessment to create a situational awareness of the emergency and to prepare to deploy resources in response to the needs that have been identified at the site of the disaster. Assessment and crisis action planning is done in this phase. Availability of critical information is key as is any information that would aid in the development of the assessment.
- Phase II – Respond. This is the phase where support efforts begin to happen including the movement of forces and equipment to provide support as needed. In this phase where resources are deployed to the international disaster site,

information sharing among all participants, whether through the Multinational Command Center or otherwise, helps establish liaison support and interoperability.

- Phase III – Execution. This phase is where mission support operations are conducted and ends for the military when USAID/OFDA no longer needs the military assistance. Information and information sharing needs to support these operations are provided in a variety of diverse ways depending on how an organization is supporting the mission.
- Phase IV – Transition. Through planning and coordination with the Embassy within the affected country along with the USAID/OFDA, the military will transition their resources from the mission. Information sharing is key to the planning process to collaborate on the best way to transition the military mission.
- Phase V – Redeployment. This phase reflects the return to home station for the forces deployed once the relief effort is completed.

These six phases, especially Phases I through V, tend to overlap to some extent. For example, at the beginning of a disaster relief event, getting timely assessments to a planner are essential in order to provide to put together the resources necessary to respond to the crisis. These plans are necessary for the Response phase which follows. The type of information that is collected and shared must be both timely and add value in creating a what the U.S. military has termed a Common Operational Picture. As the operation progresses through these various phases, in many cases, assessments will be made to monitor the response and make updates to the Common Operational Picture that is shared with partners.

In preparation for disasters, organizations must collect information that is useful for guiding response efforts and available to members immediately when the natural disaster arises. For example, the U.S. military collects information on airfields, shipping ports, communications capabilities, frequency management requirements, hospitals and hospital capabilities, infrastructure, and power, to have planning information readily available during their planning.

During the Execution phase of an HA/DR event, efficient information sharing becomes paramount. Every HA/DR is unique. Depending on the type and magnitude of the disaster, different organizations will engage whether they be government, non-governmental, or military organizations. Each organization needs access to an entire spectrum of information to plan and coordinate appropriately. Sharing this information also contributes to a collaborative approach when providing relief. These organizations also need a venue in which to share information with other organizations to get a clear idea of what is going on, or a common operational picture. In post relief efforts, there are many organizations that document lessons learned to suggest solutions to improve future HA/DR responses. These lessons learned cases are made widely available through JLLIS.

Process Support Level

There is an involved process of accessing the U.S. military's resources in HA/DR efforts even though there are major combatant commands that have humanitarian assistance and disaster relief as part of their defined missions. It even gets more complex when the relief effort is in a foreign country. The United States military cannot make a unilateral response. It must be vetted through the appropriate processes which includes coordination with the host country government, the U.S. Ambassador to that country, the Embassy, USAID and the State Department. It is only at that time that the U.S. military may be asked to assist and in what role.

Figure 2.1 taken from an operational level HA/DR briefing, provides an overview of the processes involved in requesting U.S. DOD support.

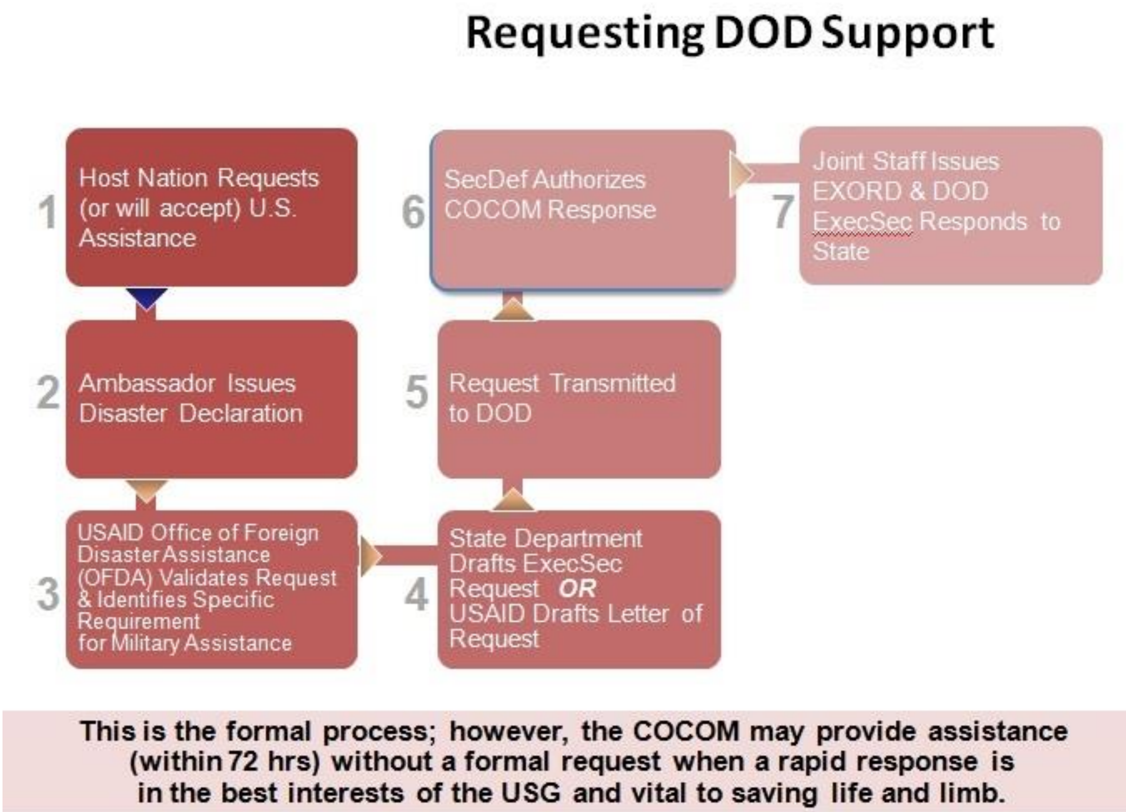

Figure 2.1: Process Support Level

When the U.S. military is asked to assist in a humanitarian assistance/disaster relief response, they operate at various levels. There are three levels of support defined for this study: strategic, operational, and tactical. Carl Philipp Gottfried von Clausewitz was a Prussian general and military theorist who is still studied today throughout military communities around the world. His theories were, of course related to war, but his ideas are also relevant to military-operations-other-than-war (MOOTW), such as a humanitarian disaster relief operation. (von Clausewitz, 1989). Clausewitz provides an enduring framework from which militaries can build staffs as they plan, conduct and coordinate operations as efficiently as possible. The U.S. military has adopted this same framework in its literature and the standard operating procedures document entitled, *Multinational Planning Augmentation Team Multinational Force Standing Operating Procedure* (MPAT MNF SOP), suggests that their expected efforts across different process support levels are no exception. Table 2.1 shows how von Clausewitz's theories (1989) are still relevant when considering operations whether it be for war-time or other operations.

Table 2.1 Process Support Levels– von Clausewitz and MNF SOP

	von Clausewitz	MNF SOP
Strategic	The strategic level of war is concerned with the art and science of employing national power.	Development and employment of national/multinational level resources; national interests at stake.
Operational	The operational level of war is concerned with the planning and conduct of campaigns. It is at this level that military strategy is implemented by assigning missions, tasks and resources to tactical operations. A controlled series of simultaneous or sequential operations designed to achieve an operational commander's objective, normally within a given time or space. See also operational level of war.	Translate strategic objectives into tactical tasks via strategies campaigns, and major operations.

Tactical	The tactical level of war is concerned with the planning and conduct of battle and is characterized by the application of concentrated force and offensive action to gain objectives.	Employment of forces at the "execution (field) level" to execute approved military courses of action.

In an HA/DR response, the U.S. military can be asked to provide support at any of these levels, sometimes it is multiple levels. Further, the levels of support can change as the operation transitions through the various phases. Therefore, the process support level for planning and execution where information is shared is a factor considered in this research. For example, if the organization is addressing first-responder needs, the information that is available may only be at the tactical level, such as a readily available low-bandwidth solution such as a tweet or text message, which could provide location and details of the real-time situation. While other organizations may be involved only at the operational or strategic level where the number of pallets of water, medical supplies, bridges and supply route conditions, infrastructure needs, airfield and port capabilities, hospital capabilities and the like, would be their focus. This information will allow responders to plan and execute the operation so that the necessary transportation and/or delivery systems can be provided to get these resources to where they are needed. Thus, the technology that is used may change based on the role the military in support of an HA/DR effort.

Military Command

The U.S. military has a complex organization chart with a multitude of levels that may have authority and/or responsibility for different foreign disaster response efforts. The hierarchical structure of the organization chart of the U.S. military includes multiple boxes, that represent command functions, which provide either line or staff services to the military.

Figure 2.2 from the Air War College shows what a Joint Organization Task Force might look like (http://www.au.af.mil/au/awc/awcgate/pub1/chapter_1.pdf). Pay particular attention to the number staffs, they are almost identical to the staffs defined in the *MNF SOP* with the exception of the Civil-Military Operations Staff.

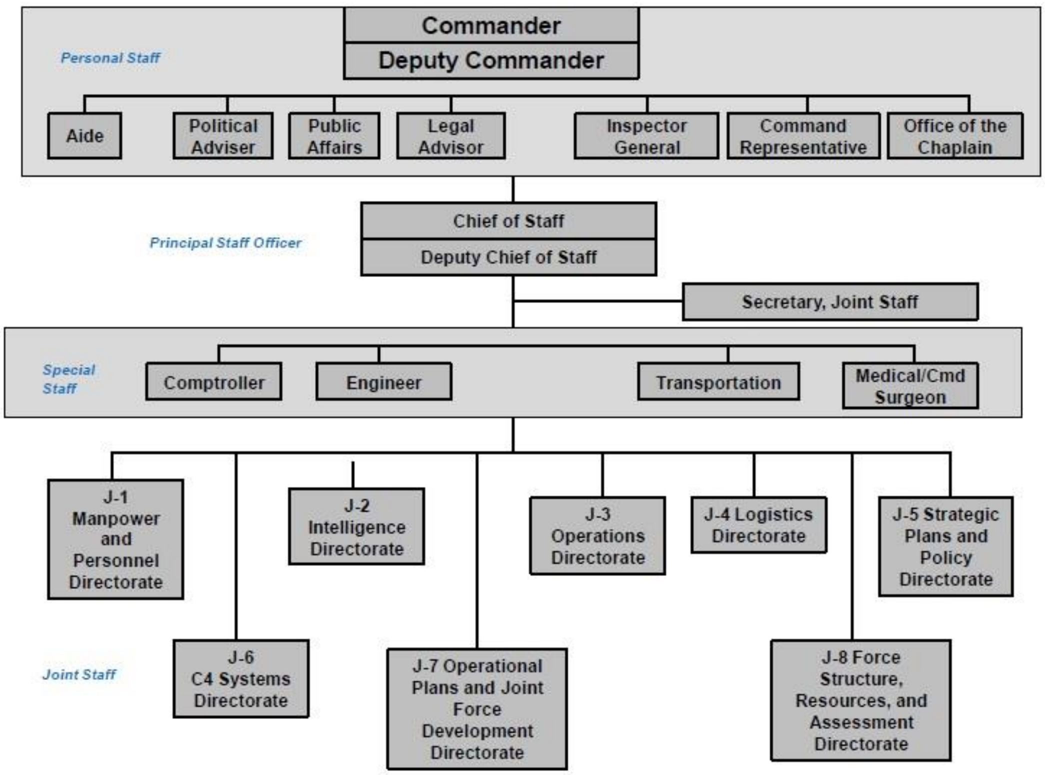

Figure 2.2 Joint Staff Organization

Table 2.2 cross-walks this figure to allow comparison of these staffs that are defined in the *MNF SOP*, and as they are structured for the United States Joint Staff, and U.S. Agency for International Development (USAID).

Table 2.2: Military Command Staffs

Staff Function	MNF SOP	U.S. Joint Staff	USAID FM
Personnel	C1 Personnel	J1 Personnel	J1 Administration
Intelligence	C2 Intelligence	J2 Intelligence	J2 Intelligence
Operations	C3 Operations	J3 Operations	J3 Operations
Logistics	C4 Logistics	J4 Logistics	J4 Logistics
Plans and Policy	C5 Plans and Policy	J5 Plans and Policy	J5 Plans and Policy
Communications	C6 Communications and Information Systems	C6 Command, Control, Communications and Computer Systems	J6 Communications

Note: In this table, the J-7 Joint Force Development Directorate and the J-8 Force Structure, Resources and Assessments, were not included primarily because there are no equivalents in either the MNF SOP, or the USAID Field Manual.

This table shows how the structure of the task force defined in the MNF SOP is closely aligned with the how the Joint Staff is structured. You will also find similar structures in command staffs throughout the military. The other key point here is that USAID, a key inter-agency player in all foreign disaster response efforts, has provided their staffs with information about what they should expect when working with the military at a disaster site in their field manual. This information provides USAID and other agencies who participate in the foreign disaster response with a basic understanding of the staff structures. Knowing this allows all partners to collaborate more effectively.

Thinking specifically about an HA/DR event, there are six command functions that are executed prior to, during and after the disaster event. They include Personnel, Intelligence, Operations, Logistics, Plans, and Communications. Staffs in each of these commands are critically important to the success of disaster relief efforts. Personnel working in each of the commands are usually trained within their specialty in order to provide the services and equipment required by the functional areas to which they are assigned. The technology they use to share information is also impacted by the function they are performing.

The Personnel Command staff manages personnel and personnel administration, develops personnel policies, administers military and civilian personnel from all nations participating in the disaster response. Per *Joint Publication 1-0, Personnel Support to Joint Operations*, Personnel staff manages personnel and administration, develops personnel policies, administers military, and civilian personnel from all nations participating within the Combined Task Force (CTF). Here are some of the functions for which a Personnel staff would be responsible:

Individual Augmentation Planning and Procedures

Joint Reception Center and Joint Personnel Training and Tracking Activities

Personnel Accountability and Strength Reporting Encompassing Military,

Department of Defense, Civilians, Contractors, and Multinational Personnel

Pay, Allowances, and Entitlements

Postal Operations

Morale, Welfare, and Recreation

Casualty Rates and Reporting

Awards and Decorations

Performance Reporting and Tracking

Civilian Personnel Management

Reserve Component Call-up

Stop-Loss Authority

Noncombatant Evacuation and Repatriation Operations

Personnel Recovery Considerations

Personnel Support to Multinational Operations

(Source: Joint Publication 1-0, Personnel Support to Joint Operations)

The Intelligence Command staff's basic function is to ensure the availability of reliable intelligence and timely indications and warnings on the characteristics of the area of operations and the location and activities. One of the primary responsibilities of the Intelligence staff is to address joint, interagency, and multinational intelligence sharing and cooperation. During Operation Unified Assistance, the III Marine Expeditionary Force (III MEF) J2 Action Officer posted daily updates to APAN to ensure the entire staff and task force have timely updates and situational awareness. Usually intelligence information is protected meaning information is closely held and not shared. However, in a relief operation, commanders have more flexibility.

The C-2 staff's basic function is to ensure the availability of reliable intelligence and timely indications and warnings on the characteristics of the area of operations and the location and activities. When operating in a multi-national environment, the level of classification pertaining to national security interests and the appropriateness of releasing the information to other countries is paramount. For the most part intelligence information in a HA/DR effort will be unclassified and usually provided on a commercial network in order for it to be available to all countries who are participating in the relief effort. This kind of unfettered information access is valuable for situational awareness and planning. There are other networks that can be used when there are proprietary systems in place to ensure that the information on these technology platforms is protected, yet accessible to those who already have clearance. There are networks which are used by the intelligence community just for this purpose. There are also networks that can be setup and deployed almost immediately if the disaster response is bi-lateral, and in some instances multi-lateral, where certain partner countries participate and for which the configuration of these networks are previously agreed upon through formal agreements.

In the case of a multi-national response, a commercial network will give the disaster relief community of organizations the widest possible dissemination of information for planning and coordination of the effort. That is why APAN was the collaborative solution of choice in the two case studies. This information platform operates on a commercial network and the proof of concept has been demonstrated numerous times in multi-national exercises to simulate a multinational disaster response scenario. Intelligence staffs, who are used to working in a classified environment, are often challenged to adjust to an unclassified environment in order to perform their information gathering and dissemination responsibilities. The information they provide can be in various forms, such as maps providing situation awareness and a common picture of the operation, announcements of intelligence information as it is gathered, and so on. Intelligence personnel must also examine information for planning and analysis.

The Operations Command staff assists the in the direction and control of activities that occur on the ground during the foreign disaster relief operations. the focus is responding to the crisis in a way that is synched up with other commands with who they are coordinating. This is done by implementing a "battle rhythm", the term that the military uses to establish a daily 24-hour schedule of events to coordinate, to plan and to execute as the operation unfolds.

If there is one place that information is crucial, it within the Operations staff. Cross functional operational planning teams will be formed to address specific planning needs. These teams are composed of subject matter experts from across the staff. Throughout the *MNF SOP*, planning teams are called out based on the operation that is being undertaken. During Operation

Unified Assistance, APAN hosted daily update briefs that were used to discuss the current situation, discuss both current and future operations, and make decisions on the most appropriate courses of action. Databases were also hosted on APAN, that captured information to respond to Requests for Assistance. Thanks to these databases, with a click of a button information could be downloaded in a spreadsheet format allowing for easy sorting and prioritizing thus allowing planners to build their plans to meet operational goals. The battle rhythm usually features commander's briefings, daily shift change briefings, and other functional areas as needed.

The Logistics Command staff prepares campaign, concept, and operation plans, and the associated Commander's Estimate of the Situation. They develop logistics plans and coordinate and supervise supply, maintenance, repair, evacuation, transportation, construction, and related logistics activities. Logistics is the key to the success of any operation whether it be military or civilian. Planning, coordination and pre-arranged agreements for supplies, equipment and manpower in a multinational response effort can make the difference in the timely delivery of personnel and equipment. Logistics in a multinational environment becomes a shared responsibility. It is important that information be exchanged in an accurate and timely manner to provide the most efficient means of meeting the mission requirements. Nearly all information shared by the Logistics Command is structured in nature since logistics deals with precise data.

The Plans Command staff does the long-range, or future operations, planning and short-term, or current operations, planning. The current operations planning is conducted for the next 96 hours of the operation and future operations planning covers the 96 – 198-hour timeframe. Planning meetings are also an important part the battle rhythm. It is at these meetings plans are reviewed and discussed and agreed upon in order to gain efficiencies and keep the task force on the same working together toward the same mission. This includes the planning, integration and coordination of combined joint operations for disaster specific task forces. The short-term planning is referred to as Current Operations and the long-term planning which gives a further look into the future is referred to as Future Operations. The information contained in the Current Operations and Future Operations briefings are essential to the staff for information on the current on-going operations as well as future operations, so they can plan accordingly. With its focus on crisis response, the *MNF SOP* defines a specific process for Crisis Action Planning (CAP). The phases of the CAP process include: Situation Development, Crisis Assessment, Course of Action Development, Course of Action Selection, Execution Planning, and Execution. Data types are usually mixed.

In general, the functions of the Communications Command staff include handling command responsibilities for communications and frequency control, tactical communications planning and execution, and management and development of electronics and automatic information systems. Almost all the data need to support these responsibilities is structured.

There is a broad spectrum of networks that support a wide variety of information. The network used usually depends on the level of classification assigned to regulate each user's access to information. If information is classified, the network that supports this must be classified at the same level. There are networks that support intelligence information gathering and exchange, called the Joint Worldwide Intelligence Communications System, known as JWICS. The network used to support unclassified information for the Department of Defense is called the Non-Secure Internet Protocol Router Network, NIPRNET. This network can handle information that is up to Sensitive, but unclassified. The Department of Defense primary network for classified information, is the Secret Internet Protocol Router Network, SIPRNET, which is also used by the Department of State for handling classified information up to Secret.

There are additional networks that support communications with other nations. Some are bi-lateral, in that the networks are established between two countries in order to communicate and coordinate. Some of these networks are multinational and include selected countries willing to share information with each other. The information shared is usually classified and therefore is protected as such and covered by a formal agreement.

Another factors to consider is that systems administration function for the multiple systems that run on these various networks. This function documents and facilitates the inter-communicability of servers that support things like email, database systems, collaboration, and so on. Other systems administration tasks include account management and user access control. Additional responsibilities can include properly configuring everything on these networks including the individual workstations to protect the network.

To add to the responsibility of the Communications Command making sure the proper frequencies are used for radio communications is a major responsibility. This is referred to as spectrum management. This is important for providing proper communications to units about the use of radio frequencies to communicate and to avoid interfering with civil-defense and police pre-established use of frequency ranges, especially when working in other countries.

Depending on the disaster response, other partners may be integrated into Joint or Combined Task Force, or at least work in coordination of the task force. More details about the kinds of partners that the U.S. military is likely to engage is the topic of the next section.

Partners

This research is conducted predominantly from the perspective of the U.S. military, since the U.S. military is often one of the first responders for HA/DR efforts around the world. One of the lessons learned within weeks following the 9/11 attacks, was that there were federal government organizations that had information that was normally closely-held but that needed to be shared with other organizations which were responding to the domestic crisis. A big challenge in sharing with partners in this ad hoc, virtual organization was a lack of established protocols for providing information across a wide variety of technology platforms and in varying formats.

Related to this lesson learned, the Governor of Hawaii, the Honorable Linda Lingle, approached federal, state and local agencies in the islands regarding the problem of information sharing and working together for the sake of meeting a common objective, whether it be national defense, homeland security or reacting to a natural disaster. In response, representatives from the Command, Control and Communications directorate at the United States Army Pacific Command, in Fort Shafter, Hawaii, showed up at the United States Pacific Command, in Camp Smith, Hawaii, to discuss with the technical staff of the Asia-Pacific Area Network (APAN), solutions for sharing information among staff who would normally keep information held close.

This was the beginning of a national push to start breaking down walls within and between federal, state, and local organizations to share critical information to gain additional insight into the status of data sharing across the U.S. military and including U.S. federal government organizations. This type of situational allows decision makers at the federal government level and at the organizational level to make better, more informed decisions.

Although often diverse in their organizational culture, in a disaster response operation, organizations are similarly asked to work together toward a common goal. Information sharing, planning for information sharing, pre-establishing systems authorizations and designing systems for transferring information across all technology platforms, is critical in achieving that goal.

Organizations that are a part of the U.S. military are many times major partners in HA/DR efforts, both domestic and international. In this analysis, the organizations with whom the U.S. military is likely to partner are organized into two categories: internal and external. As the labels imply, internal partners include traditional organizations that are part of the American federal government system. External partners, by contrast, refers to any non-traditional organizations that are not under the direct authority of the federal government. Descriptions of common internal and external partners in a foreign HA/DR event is provided next.

Internal Partners

There are a multitude of partners who are typically involved in an HA/DR relief effort. According to *Joint Publication 3-29*. Foreign Humanitarian Assistance (FHA, p. I-1),

> *FHA operations (including FDR operations) are normally conducted in support of the United States Agency for International Development (USAID) or the Department of State (DOS).*

The U.S. military regularly plans for its supporting role which will require the military and all relief partners to work together. For example, the State Department, a part of the U.S. government, and one of the Lead Federal Agencies, along with USAID**,** maintains an extensive database about nations around the world. The information is primarily for U.S. citizens that are traveling or long- term residents in the disaster impacted country. State Department databases provide information such as passport validity and visa requirements, vaccines, and currency restrictions. They also provide information regarding embassies and consulates within the country, demographics, safety and security, local laws and special circumstances, health, travel, and transportation in the country.

The State Department information is valuable to the planners for an HA/DR effort. Databases provide demographics of the area impacted, languages spoken, and other relevant information. The important thing to note, is that the database format can be easily accessed across any country and/or region that the planners as well as other staffs can use.

USAID (Office of Foreign Disaster Assistance Support) collects information about Private Volunteer Organizations (PVOs) operating in countries throughout the world through their registration process. This data is used by USAID to identify partners the U.S. military can work with and who have access to country resources and expertise.

External Partners

In a foreign disaster relief effort, there are many organizations involved including relief agencies, non-governmental agencies, international organizations and possibly foreign and domestic militaries. Each of these organizations brings diverse capabilities and much needed personnel skill set, resources and in some cases equipment. External partner organizations also have structured and unstructured data that is available in a multitude of technology platforms. Who the U.S. military is likely to partner with and examining the ways in which information is share information for a coordinated response deserves examination as a part of these research. Typical external partners and the data they offer are reviewed next.

The United Nations (UN) plays a major role in providing critical information related to disasters worldwide. The UN Office for the Coordination of Humanitarian Affairs (OCHA) has a website, ReliefWeb, which is a leading humanitarian information source for global disasters. The primary objective of ReliefWeb is to provide reliable and timely information to those that are involved a disaster relief response. This provides the community (organizations, people or both) with information that can assist them in their planning efforts, inform disaster relief staffs of current operations and enable them to make more informed decisions about necessary action steps in any type of HA/DR event. The United Nations (UN) also uses what they call the Virtual

On-Site Operations Coordination Centre (OSOCC) to help coordinate international relief efforts and provide a collaborative platform to coordinate and share information among the international responders. The UN's World Food Program gets food to where is needed in a time of emergency relief during natural disasters and as well as civil conflicts and war. Since both short and long-term planning in necessary for UN operations, data sharing with the U. S. military is expected to occur via structured and unstructured formats.

The International Committee of the Red Cross and The International Federation of Red Cross and Red Crescent Societies (IFRC) are international organizations based out of Geneva Switzerland providing global support for humanitarian assistance. For reasons similar to the UN, data sharing with the U. S. military is expected to occur via structured and unstructured formats.

Host Country Government Officials must communicate with Ambassadors and Chiefs of Mission from other countries when assistance from those countries is being requested. These communications tend to be more unstructured.

Data Sharing Technology

The sharing of time sensitive information between relief stakeholders following a major disaster is critical for an efficient relief operation (Fan & Bo, 2016) (NPS, 2012). Leaders, regardless of their leadership style, regardless of their role or level of responsibility, need high quality and timely information to make the best decisions for achieving organizational goals and objectives. Humanitarian assistance and disaster relief efforts, especially foreign disaster relief efforts, bring together a very diverse group of contributors each with its own culture, business processes, expertise, and resources. This adds to the complexity of information sharing and exchange (Bjerge & Benedikt, 2016). However, the one common factor between these groups is they are working to one singular goal: to provide relief to the suffering. This is important because, as Leonard Wong (Wong, 1992) showed, in a leader-group interaction model, organizational goal acceptance leads to better group performance.

The United Nations High Commission for Refugees understands the importance of information sharing. They have a handbook entitled: *A UNHCR Handbook for the Military on Humanitarian Operations* (UNHCR, 1995). In this handbook, they address the importance of sharing information with the military. The Department of Defense also values information sharing and has a publication entitled the *Department of Defense Information Sharing Implementation Plan* (DOD, 2016) that "identifies tasks to drive cultural transformation as needed to better promote the practice of information sharing" (p. II). When many militaries must work together, it is essential to have a guiding document to operate together as a coalition, a team of teams. That document for the Pacific Area of Responsibility is the *Multinational Force Standing Operating Procedur*e (MNF SOP, 2018). This document helps facilitate a cohesive group when a disaster relief effort or small-scale contingency requires assistance in the form of a coalition or combined task force. Information sharing is identified as being essential part of any combined operation and provides formats and procedures for sharing information.

Ad hoc workgroups whose membership is driven by a specific situation, such as an international humanitarian assistance/disaster relief effort, can become more cohesive with a common objective, such as providing relief. The more that information can seamlessly be shared across organizational boundaries, the more likely it is that leaders of each respective organization can make better decisions and plan effective and coordinated courses of action. To make this happen, it is important to determine the best way to share information in a time when there are multiple technologies that are available at low cost and can be operated in real time with very little infrastructure.

For example, in the past decade, social media has garnered a tremendous amount of attention for its ability to get information distributed not only locally, but also regionally and globally in a short amount of time. This feature has propelled social media into an important medium to share information. It has been used in disaster relief efforts as an effective tool for gaining situational awareness, especially for first responders (Hossain & Kuti, 2010). The information provided is timely, but not always verifiable, yet it is unstructured, which allows the user to share information without the constraints of a formatted response. The differences between structured and unstructured data and how they may apply to U.S. military disaster relief efforts are considered next.

Structured Data

Webopedia defines structured data with this description: "Data that resides in a fixed field within a record or file is called structured data. This includes data contained in relational databases and spreadsheets." Structured data definitely plays a role in disaster relief efforts (Kinsella, Wang, Breslin, & Hayes, 2011). The United States Agency for International Development / Office of Foreign Disaster Assistance (USAID/OFDA) makes use of a Mission Tasking Matrix, also known as a MITAM, which is a perfect example of structured data. The MITAM has a well-defined format and for good reason. It provides the relief organizers information they need and in a format suitable for planning disaster relief efforts.

Structured data benefits from first creating a data model – a model of the types of data that will be recorded and how they will be stored, processed and accessed. This includes defining the fields of each data category that will be stored as well as in what format that data will be stored: data type (numeric, currency, alphabetic, name, date, address) and any restrictions on the data input (number of characters; restricted to certain terms such as Mr., Ms. or Dr.; M or F).

Structured data has the advantage of being easily entered, stored, queried and analyzed. At one time, because of the high cost and performance limitations of storage, memory and processing, databases and spreadsheets using structured data was the only way to effectively manage data. Anything that couldn't fit into a tightly organized structure would have to be stored on paper in a filing cabinet.

For the purposes of this dissertation, I define structured data as data that is organized in a pre-defined manner, much like the databases and spreadsheets as described above. The reason for this is that as we examine the approach for the type of data and data applications to be used for information sharing for complex foreign HA/DR efforts, the reader will understand the different approaches and technologies involved.

Unstructured Data

Unstructured data is opposite of structured data, since this data is not systematically stored by the creator or made available in a traditional database. Unstructured data includes things like text messages, emails, blogs, wikis, forums, etc. Basically, unstructured data can be defined as anything that does not require the definitions of fields and formats, nor are there restrictions to provide specific information in fields or the necessity of producing the kinds of formats and records that make up a traditional database, list or spreadsheet.

Unstructured data can be more time-sensitive and provide can real-time information that allows partner organizations to synchronize their respective activities during each disaster response phase. In addition, the data is responsive to changing circumstances on the ground and provides the information necessary to modify disaster response activities to meet ever-evolving needs. The challenge of unstructured data is that there is seldom sufficient time to document and/or verify the authenticity and accuracy of information sources. In addition, from the U.S.

military's perspective the information may be valuable to unknown or unspecified partners on the ground for whom no security vetting is possible.

The success or failure of the tasks provided by the can be influenced by the manner in which data are shared. Structured data have the advantage of being prepared in advance. This allows for the security restrictions on the data to be established which will provide guidance concerning with whom the data may be shared in real time. Unstructured data, though, offers the advantage of real time data that is accessible to a wider range of partners as well as interested persons impacted by the disaster. Having at one's disposal multiple technology platforms, each uniquely suited to structured or unstructured data, requires an awareness of how to balance data security considerations with the need to know information in real time.

In this section, an overview of the four factors that could influence the U.S. military's choice of technology platforms for sharing disaster relief response information were reviewed. The first factor focused on disaster relief tasks during six different phases of a disaster response. Three additional factors, process support level, military command and partners were described since they may offer alternate explanations for data sharing activities. For normative guidance on how the U.S. military can optimize data sharing technology during foreign disaster relief activities, we now turn to scholarly literature.

Task Technology Fit Theory for Corporations

Task-Technology Fit theory proposes that information and communication systems that are aligned with individual tasks (Goodhue, 1995) or group tasks (Zigurs & Buckland, 1998) will have a positive correlation to performance. Since cohesive teams are usually more efficient and effective in the performance of their tasks and more likely to share information among members, it makes sense to analyze the use of technology to perform the tasks at hand and how the fit between tasks and technology contribute to performance outcomes. The definitions of the tasks and technologies and predicted relationships between different categories of each are presented in this section.

Tasks

There are five tasks in the Task-Technology Fit theory. They are:

1. Simple Tasks: Simple Tasks are just that, simple. They have a single outcome and with no interdependencies.
2. Problem Tasks: Problem Tasks add an additional layer of complexity. It focuses on the best course of action with one well-defined outcome.
3. Decision Tasks: Decision Tasks address the best solutions with multiple outcomes.
4. Judgement Tasks: When it comes to Judgement Tasks, information processing is paramount especially since it deals with resolving conflict and uncertainty associated with the task.
5. Fuzzy Tasks. Fuzzy Tasks deal with tasks that require the group to understand and structure the problem.

Technology

Even though Task Technology fit theory focuses primarily on the tasks performed by individuals inside an organization, Zigurs and Buckland (1998), they also realized and accounted for the necessity of analyzing tasks as they are performed by members of a group acting as a cohesive unit. They introduced the concept of Group Support Systems. This concept encompasses a wide range of decision technologies that assist individuals with a task-based group in identifying and addressing problems and contributing to the completion of group tasks.

There are three dimensions of the Group Support System that are designed to work together: Communications Structuring, Process Structuring, and Information Processing (Zigurs & Buckland, 1998). The first dimension, Communications Support provides the target audience with the ability for its members to communicate interactively both in real-time such as teleconferencing and chat, and near real time such as threaded discussions and forums. Process Structuring, as the second dimension, includes technology platforms that support the technological processes required to complete a task, such as a work-flow application. Attention to the technology platform is necessary to enforce process rules that are well-defined, consistent, and flexible within the constraints of business rules. The third dimension, Information Processing, encompasses the ability for all group members to collect, organize, share, access and evaluate information in specialized formats.

Table 2.2 is drawn from the work of presented in Zigurs and Buckland (1998) predicts the fit needed between five task categories and three technology dimensions.

Table 2.3: Expected Relationships for Task-Technology Fit Theory

	Communications Support Dimension	Process Structuring Dimension	Information Processing Dimension
Simple Tasks	High	Low	Low
Problem tasks	Low	Low	High
Decision Tasks	Low	High	High
Judgement Tasks	High	Low	High
Fuzzy Tasks	High	Medium	High

Adapting TTF Theory to the U.S. Military's Foreign HA/DR efforts

For this research, the expectations embedded in Task-Technology Fit theory will be used as the theoretical framework to examine whether technologies that support unstructured data such as Web 2.0 technologies and social media, or technologies that support structured data such as databases, spreadsheets tables and other delimited forms are better suited prior to, during and after a humanitarian assistance/disaster relief effort (as displayed in Table 2.4).

The TTF theoretical framework is suitable for adaption and application to the HA/DR environment since both are dynamic and multi-dimensional like are the information and task requirements in corporations. However, the task requirements change over time as disaster relief efforts move through the various HA/DR phases. Starting with the Task-Technology Fit as a theoretical framework, the researcher modified the task characteristics, technologies used and the type of data they supported (structured or unstructured) to assess the fit between tasks and data shared across the HA/DR disaster response.

For my adaptation of the task-technology fit model as it would apply to HA/DR settings, I have identified four independent variables that may influence the fit between task and technology and condition the overall fit between task and technology. The first independent variable uses the tasks that are performed in the six different phases of a HA/DR response.

Adaptation of Tasks as Phases in HA/DR Events

The first section of this chapter described six standard phases that guide the activities of the U.S. military during foreign disaster response efforts. These phases parallel the types of tasks that were identified in the Task Technology Fit theory. A cross-walk of phases and tasks is provided next.

- Phase 0 – Prepare. The main tasks for the U.S. military in this phase are to shape the environment. These tasks are accomplished through collaborative endeavors such as conferences, training and exercises with other regional partners. These tasks are considered to be equivalent to Judgement tasks in the Zigurs & Buckland framework.
- Phase I – Assess means to develop a situational awareness of the emergency. Assessment and crisis action planning are the main tasks. These tasks are considered to be equivalent to Simple tasks in the theory predicting fit of task and technology.
- Phase II – Response tasks relate to the movement of forces and equipment to provide support. In this phase, information sharing between all partners helps establish liaison support and interoperability. These tasks are considered to be equivalent to Problem tasks in the TTF framework.
- Phase III – Execute describes how support operations are conducted. Information sharing to support these tasks are provided in diverse ways depending on how an organization is supporting the mission. For these reasons, these tasks are considered to be equivalent to Fuzzy tasks in Zigurs and Buckland's theory.
- Phase IV – Transition activities feature the planning and coordination with the Embassy within the affected country along with the USAID/OFDA, in order for the military to transition their resources away from the disaster relief mission. Information sharing is necessary to collaborate on the best way to transition the military mission out of country. For these reasons, these tasks are considered to be equivalent to Decision tasks in the Task-Technology Fit framework.
- Phase V – Redeployment features tasks that analyze the most efficient and cost-effective ways to return military resources to the home station once the relief effort is completed.

For these reasons, these tasks are considered to be equivalent to Problem tasks in the Zigurs and Buckland theoretical framework.

As I noted earlier in this chapter, these phases, especially Phases I through V, will overlap to some extent. The logic of the cross-walk between tasks and HA/DR phases follows.

- Simple Tasks have a single outcome and with no interdependencies. Adapting this category to the HA/DR setting, Phase I, Assess is categorized as a simple task since the outcome is to provide damage, environment and causality assessments with no decisions require, just the assessments so planners can determine courses of action.
- Problem Tasks focus on the best course of action with one well-defined outcome. In the U.S. military HA/DR efforts, Phase II, Response and Phase V, Redeploy, feature activities that have multiple potential courses of action that must be analyzed.
- Decision Tasks address the best solutions for multiple outcomes. Adapting this category to the HA/DR setting, Phase IV, Transition is a decision task because decisions have to be made as to how, what and when the military transitions its role back to the relief organizations. These decisions are collaborative in nature and depend on the operational status of the relief effort.
- Judgement Tasks require processing shared information to resolve conflict and uncertainty associated with a specific task. During Preparation, Phase 0, the U.S. military is faced with Judgement tasks as they must balance the status of diplomacy with various countries with the uncertainty of the type of disaster to which the organization will be tasked with responding.
- Fuzzy Tasks are tasks that require a group to understand and structure the problem. This is equivalent to Phase III, Execute, for HA/DR efforts by the U.S. military since pre-

programmed responses developed through Phase 0 military exercises need to be modified in real time to fit the country and the disaster as well as the evolving disaster response situation on the ground.

Adaptation of Technology Types in HA/DR Events

The Communications Support dimension of technology in the TTF theory is important for assuring that members can communicate interactively in real time. These activities clearly align with the sharing of unstructured data which is hosted on technology platform known for open communication modalities and real time distributions of information.

The Process Structuring dimension is necessary to make sure includes technology platforms support processes required to complete tasks. This dimension also enforces process rules for using technology in ways that are well-defined, consistent, and flexible within constraints established by the organization. When considering the U.S. military, rules and constraints are necessary for structured data, but so is the ability to share on the ground condition information immediately for task completion. For this reason, a mix of Unstructured and structure is expected for the adaptation of the Zigurs and Buckland TTF frameworks process structuring dimension.

The Information Processing dimension is necessary to ensure that the ability of all group members to collect, organize, share, access and evaluate information in specialized formats. In a HA/DR event, the U.S. military will provide and receive structured data from partners with whom they have worked/trained with previously. Many of these partners will have executed a bilateral agreement governing what and how information can be shared. For this reason, structured data is considered to be equivalent to the Information Process dimension in the Task Technology Fit theory.

Based on the rationales presented above, a strong case can be made when exploring the utilization of different data types as they support the three dimensions of the group support systems identified in the Task and Technology Fit theory of Zigurs & Buckland (1998). Table 2.4 cross-walks the three dimensions using examples of the data commonly shared in HA/DR events.

Table 2.4 Cross-Walk of Technology Dimensions to Data Type for HA/DR responses

Dimension	Examples	Data Type
Communications Support	Simultaneous input Anonymous input Input feedback Group Display	Unstructured
Process Structuring	Agenda Setting Agenda enforcement Facilitation Complete record of group Interaction	Both
Information Processing	Gather information Aggregate Information Evaluate information Structure Information	Structured

Using the adaptations, I have proposed for cross-walking the tasks to phases and the technology dimensions to data types, I am able to test the portability of the TTF framework to HA/DR responses of the U.S. military. The expected relationships between tasks organized by the phase of the disaster response and technology determined by the data sharing platforms that are used in each respective phase are shown in Table 2.5.

Table 2.5: Expected Relationships for HA/DR Tasks by Phase & Data Sharing Technology

	Unstructured Data	Structured & Unstructured Data	Structured Data
Simple: I Assess	High	Low	Low
Problem: II Respond & VI Redeploy	Low	Low	High
Decision: V Transition	Low	High	High
Judgement: 0 Prepare	High	Low	High
Fuzzy: IV Execute	Low	Medium	High

Additional Variables Potentially Influencing Task and Technology Fit

In this section, I present the predicted relationships for three additional independent variables that, from the literature review and my experience, are expected to come into play from the U.S. military perspective during a humanitarian assistance/disaster relief response. These factors are expected to impact the type of information that is used and the format in which it will be shared, i.e. unstructured or structured.

Process Support Level

During each phase of disaster planning and response, there can be a mix of concerns that span strategic, tactical and operational processes and procedures. For example, the disaster response activities of the U.S. military must be in line with what is contained within national (federal) and U.S. Department of Defense Strategic Plans. In addition, the response must take into consideration the tactical preferences that the impacted nation currently holds with respect to the country or geographic area in which the disaster has occurred. A third process level must also be considered simultaneous to the other two. This level is the operational level, which refers to the actual procedures and processes that the U.S. military has in place at the time the disaster response has been initiated. The types of data technology used at these three process support levels may differ based on the type of information that is being shared and who will have security clearance to receive the data. For this reason, I expect that there will be a mix of structured and unstructured data shared. To determine the accuracy of this alternate hypothesis, the relationships between process support levels and data technology will be tested.

Military Command

Disaster relief efforts by the U.S. military could require the involvement and coordination of up to six different commands within the organizational chart. The level of activity of each command during HA/DR response is documented above and provides the basis for assessing the level of correlation with different data sharing technologies. A strong and predictable correlation may mean that the military command offers higher explanatory power than does the type of task that the U.S. military performs during foreign disaster response activities.

Partners

In this research, differences between the types of technology used for data sharing with internal and external organization partners and the U.S. military during HA/DR events will be considered. These categories do not define what organizations are, and what organizations are not, considered to be partners as much as they define the sharing of information between organizations with different degrees of organizational alignment with U.S. policies and which may or may not operate under the authority of the federal government.

Internal organizations are defined as organizations that operate within a legal command structure that is overseen by the President of the United States and carried out through federal organizations. External organizations are defined as organizations outside of the command and control structure of the U.S. federal government. As such, it is not expected that there is any obligation, nor historical tradition for information to be shared with the U.S. military.

Information sharing with many internal and external partner organizations in a HA/DR response effort likely occurs on a regular and predictable basis. However, when taking into consideration the ongoing favorable relations and the likelihood of internal partners being vetted for security clearance, I expect internal partners to be the recipients of primarily structured data. This prediction is information by the fact that information sharing protocols and users and access levels are normally established in advance of the HA/DR event.

For external partners, the prediction is that unstructured data will be shared most frequently. This prediction arises from the reality that many partners in a specific HA/DR event are not known until the U.S. military has already deployed to the geographic location. Therefore, the process of granting security clearance to the organization and specific data to different users affiliated with the external partners, identifying shared technology platforms, and having on the ground technology support to actually transfer the data will take more time and diffuse the resources that are needed for the actual relief efforts.

Chapter Summary

Based on the literature, it is expected that the type of data that is shared by the U.S. military during a HA/DR event (as an operational measure of technology) will vary based on the phase which represents important dimensions of the different tasks that must be completed when the U.S. military responds to a foreign disaster event. This expectation is deductively tested in this research. First person participant knowledge of the two case studies was used to identify three additional variables associated with the U.S. military's role in HA/DR events that may also be predictors of the type of data that will be shared interactively by/with the U.S. military. This study is exploratory research into the portability of task and technology fit theory to inter-organizational collaborations that are ad hoc rather than relying strictly on routine tasks.

Therefore, based on the adapted theoretical model of TTF theory and the addition of three independent variables for testing the power of alternative explanations, this research tests the following logic model:

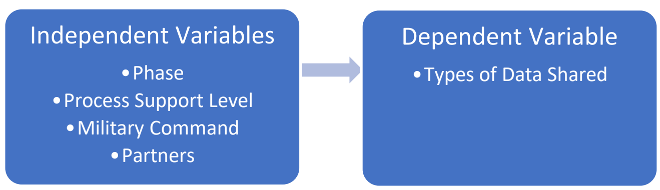

Figure 2.4: Logic Model Adapted from Task Technology Fit Theory

Based on this logic model, three research questions guide the analysis:

Research Question #1: What are the types of data shared by the U.S. military in HA/DR events?

Research Question #2: What is the relative fit between the Task variable and the types of data shared by the U.S. military in HA/DR events?

Research Question #3: Are there other factors, such as Process Support Level, Military Command and/or Partners, that provide a more robust explanation of the types of data shared during the activities of the U.S. military in HA/DR events?

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

This is a comparative case study of an implementation process (Stake, 2006). Comparative case studies allow for the analysis and synthesis of similarities, differences and patterns across cases that share a common goal. This research focuses on the sharing of structured and unstructured data between the United States military and collaborating domestic and international government and non-governmental organizations during foreign humanitarian assistance/disaster relief events. By its very nature, humanitarian assistance/disaster relief features the engagement and involvement of a spontaneously formed group of actors representing a variety of organizations from the country that experienced the disaster as well as from around the world.

Extant literature offers guidance on how best to assure the fit between task and technology. However, the theory is based on research on corporations and focuses on internal tasks and operations of which the organization has complete control. This research tests an adapted theoretical model to determine its robustness when applied to a set of ad hoc tasks that rely on known and unknown partners – specifically the U.S. military's role when participating foreign disaster relief efforts.

The outcome of the U.S. military's HA/DR effort and impact of information sharing is not being analyzed. Since these were international disaster relief efforts, all cases have the same outcome which is that disaster relief was better than it would have been had the U.S. military not intervened. It is argued that there were differences in the HA/DR interventions in terms of the use of structured and unstructured data and seeks to test four factors that may account for these differences. Thus, this analysis is a test of the design and the cases that were chosen based on the utilization of different types of data to accomplish the same task.

This research design allows for the comparison of the context and how that may have influenced the success of the intervention. Elaborating the nuances of this context can improve preparation for future disaster relief efforts to avoid loss of life and property caused by these extreme natural disaster phenomena.

Sources of Evidence

This is a mixed method study drawing from a variety of sources to overcome the weaknesses of any one data type. The unit of analysis is the organization that was included as part of the official disaster response team. The unit of observation is secondary documents related to the relief efforts combined with first person accounts of the team's activities and the fit between task and technology. The study features a mixed-methods approach that leverages the quantitative and qualitative data drawn from the secondary analysis and first-person accounts. Combined, these data sources allow for triangulation of the findings.

The qualitative data used in my analysis draws primarily from two case studies of HA/DR events in which the U.S. military played a significant role in foreign disaster response efforts. The two cases that are compared are the Indian Ocean Tsunami in 2004/2005 and the Haiti earthquake in 2010. They were purposively selected (Yin,2014) since one relied primarily on structured data and the other included structured and unstructured data.

Each case also provides a unique opportunity to include first-person observations from both the participant as well as the remote observer role of the author. The researcher's background is with the U.S. military. As part of his duties as a military planner, the researcher, as an Air Force Lieutenant Colonel, was assigned to the United States Pacific Command, was activated and assigned to the Multinational Planning Augmentation Team which was the core of the Combined Coordination Center as part of the Combined Support Force, based out of the Air Base in Utapao, Thailand during Operation Unified Assistance. He author was able to gain invaluable first-hand experience during the length of the operation. His participation benefitted from attendance at numerous Multinational Planning and Augmentation Team events such as the Tempest Express exercises and Multinational Force Standard Operating Procedures conferences and numerous PACOM hosted exercises with humanitarian assistance and disaster relief scenarios prior to the Indian Ocean tsunami.

During the Haiti earthquake response effort, the researcher was a virtual observer. He was a member of the community of interest set up by the All Partners Access Network set up specifically for this relief operation. While not integrated into the Task Force, the author was able to monitor a lot of the activity during the operation as a member of the Community of Interest set on the All Partners Access Network. As a member of this community of interest, the researcher received on-going updates as to the progress of the relief operation. This was a continuation of the author’s participation in the what was formerly called the Asia-Pacific Area Network. The author’s role in this network facilitated the sharing of information from someone with real world, real-time perspectives on the use and impact of information with the key stakeholders during the Haiti earthquake relief effort. As a result, the study data from the author’s perspective based on then hands-on experience as a military professional who was an integrated part of both HA/DR relief efforts.

The bulk of the secondary data analysis is drawn from rigorously developed lessons learned and best practices organized in a variety of military, government, educational, and private sector databases. The Joint Lessons Learned Information System (JLLIS) is a system designed to allow stakeholders to capture/document observations and best practices that the stakeholders have identified as valuable information that would provide lessons learned from crisis and steady state operations, events, and exercises that may serve as the basis to establish capability requirements if analysis indicates capability gaps.

JLLIS has been around for over 20 years and therefore provides an historical perspective as well. Many of military exercise planners review lessons learned cases in JLLIS as a means of showing trends in order to identify where training is needed to meet readiness requirements. JLLIS is also used to capture observations from real world operations in order to build meaningful training events and exercises. The observations can go through a process which moves the JLLIS entry from an observation to an issue and then a lesson learned. These issues result in policy, procedures, tactics, funding, resource deployment and other meaningful actions.

The title Joint Lessons Learned Information System suggests that is available to only the various joint organizations and combatant commands, when in fact it includes all service commands, component commands and essentially all military organizations. What also makes JLLIS a valuable resource is that it also includes entries by interagency organizations that interface with the military as well as of those that may not. Even though this primarily for military and government organizations, many observations include documentation about working with external and international partners.

Among the nearly 1,000 lessons learned documents are observations from military training exercises rather than specific foreign disaster responses. Even though these exercises are simulations and can be controlled, they offer tremendous insights into what should and should not be done on the ground in real-time disaster response activities. It is acknowledged that first-hand, real-world observations are more compelling. But there is also an interactive effect between reporting real-world and simulation outcomes as history informs future actions. Therefore, in this study, both real world and exercise observations are included as part of the analysis since each play a critical role in the selection of unstructured or structured data being used during a real-time foreign disaster response event in which the U.S. military participates.

To identify materials to be analyzed from the JLLIS database, I began by using the term "information sharing". This phrase could be in any part of the observation record which has multiple fields to capture information when capturing/documenting the observation to resolving the issue. The search extended across the entire spectrum of government and military organizations worldwide that use JLLIS. Operating as a structured database, JLLIS is the administrative system of record for recording and processing lessons learned. However, there are other military service specific lessons learn databases that also capture lessons learned. It should also be noted that only military and government organizations use JLLIS, although it contains observations that address information sharing with relief partners outside the government, including international organizations and non-governmental organizations.

In JLLIS, there were only five observations directly related to information sharing during the Indian Ocean tsunami relief effort. The low number may be due, in part, to the lessons learned being submitted during the International Indian Ocean Tsunami Lessons Learned Conference held in Chaing Mai, Thailand, held in August of 2005 where information sharing lessons learned were captured and consolidated. The lessons learned documents were available to all participants and not necessarily uploaded to JLLIS. The Haiti earthquake in 2010 generated 36 information sharing lessons learned directly related to the relief effort.

These lessons learned documents are qualitative, so the data within them is converted into quantitative values for the variables used in the analysis. A final source of secondary data are the academic case studies - books, journal articles, dissertations and theses that have covered these two events.

Variable Definitions and Coding

Most of the definitions used during this research came from the *Multinational Force Standing Operating Procedure*s developed by over 30 countries in the Asia-Pacific Area of Responsibility. The facilitators of this document are from the Multinational Planning Augmentation Team out of the U.S. Pacific Command in Hawaii. The document is an international document and addresses the variables used to do the research. Its focus is on multinational operations in the Asia-Pacific region during crisis planning but applies worldwide. Although its focus on military forces working together during crisis action events, it also addresses interoperability topics with regards to interagency partners, non-governmental organizations and international organizations. The definitions were also compared to similar definitions used by professional and academic audiences to establish consistent meanings.

There is one control variable used in this research to differentiate between the two case studies and lessons learned cases from the JLLIS database. The two case studies are analyzed comparatively across both cases and also compared with the results from the analysis of the data drawn from JLLIS. As presented in the logic model at the end of Chapter 2, there are four independent variables used in this analysis. The type of data shared is the sole dependent variable. The codebook for these variables is presented in Table 3.1.

Table 3.1: Codebook for Independent Variables

Variable Name/Type	**Code**	**Labels**
Data Source (Control)	1	Indian Ocean
	2	Haiti

	3	JLLIS
Task (IV) The phase in which the U.S. military activities occurred	0 1 2 3 4 5	Prepare Assess Respond Execute Transition Redeploy
Process Support Level (IV) The military planning level that provides procedural guidance for tasks	1 2 3	Strategic Operational Tactical
Military Command Level (IV) The organizational unit in the Department of Defense hierarchy which would oversee tasks in a HA/DR response by the U.S. military	1 2 3 4 5 6 7	Personnel Intelligence Operations Logistics Planning Communications Medical
Partner (IV) Internal partners operate under the U.S. federal government. External partners are international organizations.	0 1	Internal External
Type of Data Shared (DV)	1 2	Structured Data Unstructured Data

Based on the technology platform that supports the data	3	Mix of Structured/Unstructured Data

To capture trends over time using a quasi-experiment logic, I created a second control variable, labeled Time Periods, and performed a sub-analysis using different time periods. The Time Periods variable was coded for three time periods: 1) 1997-2004, 2) 2005-2010 and 3) 2010 – current to analyze the relationships between variables before the Indian Ocean tsunami, between the Indian Ocean tsunami and the Haiti earthquake, and after the Haiti earthquake and up to the time that the JLLIS lessons learned cases were selected in 2018. The reason for using 2005 as a starting point is that there were very few lessons learned entries in the JLLIS database before 2005, making it difficult to draw any statistical conclusions that are valid. The analysis examines the influence of time in three dimensions as shown in Table 3.2.

Table 3.2 Time Periods for Analysis

Time Periods (Control)	
Case Analysis	2005 and 2011
Quasi-experimental Event Analysis	2002-2004, 2005-2010, 2010-2018
Longitudinal Analysis	1997-2018

Threats to Validity

The selection of cases for this study is purposeful since the author can provide first-person validation of the secondary source data. However, both the data as well as the author's recollection suffer from the threat associated with recalling historical events. As more and more time elapses, and as the world experiences more and more HA/DR events and relief efforts, there is the potential for the events to be interpreted differently today than they would have been at the moment they occurred. In addition, while doing the data collection on information sharing among diverse organizations during an international relief effort, it became apparent that there were more lessons learned studies devoted to the Haiti relief effort than for the Indonesia tsunami. The analysis and findings rely heavily on triangulation of the findings to mitigate this threat to internal validity.

Basing the analysis on just two cases limits the generalizability of the findings. However, the study begins a systematic exploration of a gap in the task-technology fit literature to determine its portability from a single organization with routine tasks to an episodic virtual organization with expected and unexpected actors who perform different tasks during the phases of the relief efforts. For an exploratory endeavor such as this, sacrificing precision from the results that can be obtained when analyzing a higher number of cases in order to provide a richer understanding of the context through case studies seems to be a reasonable tradeoff. Small-n comparative case analysis allows for close examination of contextual nuances and identification of future concepts that can be included in future research to overcome the threats to the external validity of these research results.

Both of these events had a worldwide response that included first responders and relief organizations, government agencies, and non-government agencies all trying to work toward a common goal of providing relief. Both events also included multiple military's responding.

The two events selected are five years apart; a lot can change in five years. The U.S. military, as well as other federal agencies, continued during that period to improve their processes, procedures, and tactics through training, training exercises, lessons learned, and real-world operations. By the same token, other relief organizations, local, national, and international, also improved their process, procedures, and tactics including using various technologies needed to meet their daily operational objectives as well as to meet their needs during crises. Technology change is also ubiquitous. Over the time studied, technology has become more available to more people worldwide and social media and use of various Web 2.0 technologies has shown and continues to show a tremendous amount of growth.

There are multiple independent variables in the data analysis. One variable represents tasks in the various phases of a relief operation and for which we use the definition of United State Pacific Command in their Foreign Humanitarian Operations Concept of Operations. Although these phases are fairly well defined, they do tend to overlap at times. This is something that was considered during the conduct of this research. There were also times during this research the author would have to make an informed decision about the phase a task was in based on his experience, or account for the tasks in both phases and equally weighted them if a clear phase could not be categorized.

Another dimension considered during this research was the support level at which information was being exchanged, i.e. strategic level, operational level, and tactical levels. The definitions of the levels use in this research are taken from the *Multinational Force Standing Operating Procedure*s. Again, as well defined as they are, and have been for many years, in military operations, there is sometimes a nebulous area when deciding exactly what support level the information is being shared. The author's experience was used to make an informed decision about how to weight certain types of evidence. When weighting was not clear-cut, the evidence was weighted evenly to provide the most difficult case from which to draw findings.

CHAPTER FOUR

CASE #1: THE INDIAN OCEAN TSUNAMI

Disasters can be natural or man-made. Examples of natural disasters would include hurricanes, cyclones, mudslides, wild fires, tsunamis, earthquakes, volcanoes, and so on. These occur around the world, many times with little warning. These disasters vary in magnitude from simple property damage to extensive property damage and loss of lives.

One of the most devastating disasters in our life time was the Indian Ocean tsunami of 2004, which was centered off the coast of Indonesia but had devastating affects throughout the entire region as far away as the African continent. The death toll would eventually reach nearly a quarter million people. This disaster and the relief efforts that followed are of great interest not only because of the magnitude of the disaster, the huge geographic expanse, and the amount of human suffering, but also the worldwide response that followed. It was a real-world event that would validate the need for information sharing across a wide range of organizations and shape how countries would respond in subsequent disasters.

In foreign HA/DR events, there are many players involved. There are relief agencies, non-governmental agencies, international organizations and possibly foreign and domestic militaries. Each of these groups brings about unique and some not so unique roles and specialties. With organizations that have diverse capabilities and organizational cultures, sharing information with the responders is paramount for an efficient coordinated relief effort. Determining the best way to share information for a coordinated response deserves examination in order to meet the information sharing needs.

The U.S. military's role is to protect and defend our nation. However, there are occasions where the use of the military's unique capabilities can be used in a timely manner since time is of the essence in any disaster relief effort. In many instances, the military has assets and manpower resources available to it that would allow them to work and assist in inaccessible environments. Because of this, the military finds itself working with many different partners all working together toward a common goal.

The United States found itself in that role in December 2004. The III Marine Expeditionary Force (III MEF) was tasked initially with setting up Joint Task Force 536 at Utapao Air base in Thailand. This would transition to an international task force called Combined Support Task Force 536 (CTF-536) as other countries joined the relief effort and the lead nation was appointed. The CTF-536 consisted of many partner organizations including government interagency partners, non-governmental organizations, international organizations, other militaries who have their own interests in the region where the instance occurs, the United Nations, and other relief support groups.

The sections in this chapter follow the logic model presented at the end of Chapter One. Descriptions of the U.S. military's activities during the Indian Ocean HA/DR response, organized by the four independent variables, are presented in sections two to five, respectively. In the sixth section, details about the types of data that were shared is presented. Following that, the final section analyzes the relative strength of relationships between each independent variable and the dependent variable to make conclusions about the applicability of the author-adapted Task Technology Fit theory and the power of competing hypotheses for explaining the type of data shared by the U.S. military during foreign disaster relief activities.

Phases in the 2004 U.S. military Indian Ocean HA/DR Response

There are similar patterns the U.S. military uses to prepare for HA/DR responses. It is common for the U.S. military, along with partner nations, to participate in a wide variety of events that promote international cooperation and regional stability. With reference to the Indian Ocean, the United States Pacific Command (USPACOM) Area of Responsibility (AOR) covers more of the globe of any of the other geographic combatant commands. There are five other geographic combatant commands and the USAPCOM AOR shares a border with all of them. The objectives of these commands align with the regional security cooperation objective as part of the PACOM mission “to enhance stability in the Indo-Asia-Pacific region by promoting security cooperation, encouraging peaceful development, responding to contingencies, deterring aggression and, when necessary, fighting to win.” (http://www.pacom.mil/About-USINDOPACOM/)

Phase 0, Prepare

There are many regional engagement events that occur during the year in the Asia-Pacific Area of Responsibility to bring together partner nations to collaborate and work together in preparation of a combined force response in an atmosphere of cooperation. These events including planning conferences, exercises (Command post Exercises, Staff Exercises, Table Top, Field Training), functional level seminars, training and so on. Many of these events include participation of interagency government organizations, international organizations, and non-governmental organizations.

Prior to the Indian Ocean Tsunami, USPACOM conducted a Senior Communicators Seminar in Sydney, Australia in 2002, with Senior Leadership to discuss a wide range of communications issues to include working together and how interoperability would be addressed. During that seminar, the participants signed a document supporting the Pacific Endeavor exercise which was modeled after Europe’s Combined Endeavor exercise to bring the various nations together with their equipment to test interoperability issues and other communications issues.

What was also interesting about that conference is there was also a Table Top exercise conducted and "featured" the use of the Asia-Pacific Area Network and how it could be used as an operational network outside the military domain to allow all partners to share information during a humanitarian assistance/disaster relief event. The exercise scenario was a tsunami in Papua New Guinea. Even though the event was a simulation, we used data from a real tsunami that had hit the island nation a few years earlier. The Pacific Disaster Center gave us data they had and from which we shaped the scenario for the exercise. Little did we know those same technologies would be used during the Indian Ocean Tsunami. That is why you train.

Table 4.1: Description of Phase 0 -Preparation Activities for the Indian Ocean Tsunami

Tasks	**Data Types**
Training Exercises Assessments	(S/U) Joint Exercise (S) Life Cycle Outputs (S) Hospital and Air field Studies
Multinational Force Standing Operating Procedures Annual Conference	(U) Inputs/updates to MNF SOP

Phase I, Assess

Assessing the damage during the initial phase of a disaster is critical to determining the type and the extent of the relief effort. It is important for the decision makers to make informed decisions at the tactical, operational, and even the strategic levels based on the most current and timely information available. The information comes from many different sources not only because of the number of partners but also because of the wide regional expanse of the areas that were impacted. For example, the United States Navy P-3 Orion aircraft, a four-engine turboprop anti-submarine and maritime surveillance aircraft, out of Kadena Air Base, Okinawa, provided aerial photos that were made available to the Combined Task Force through the Army Corps of Engineers and shared through the Asia-Pacific Area Network for assessment by all partners. This information was valuable in providing visual information to first responders and planners to determine supply routes, as well as to provide an initial estimate of the extent of damage and loss of life. Shortly after the tsunami struck, Disaster Relief Assessment Teams, as part of the Joint Task Force, were on the ground in Thailand, Sri Lanka and Indonesia to provide valuable information to the task force for making damage assessments. The Japanese military, flying C-130 aircraft, also sent out assessment teams to determine the extent of the damage.

Table 4.2: Description of Phase I Assessment Activities for the Indian Ocean Tsunami

Tasks	**Data Types**
Damage Assessments	(U) Damage Assessments
Food and Shelter estimates	(U) Internally Displaced Persons (IDP) Reports, NGO reports, Hospital reports
Main Supply Routes (MSR)	(U) MSR reports from military units, civil authorities, populace

Phase II, Deploy

The Deploy Phase was multi-dimensional because of the many partners that participated in the relief effort. At the operational level, military units were deployed rom various services, Army, Navy, Air Force, Marine, and Coast guard. They worked together and organized initially into Joint Task Force 536. With military units from around the region and around the world integrating into the relief effort, the task force transitioned from a Joint Task Force to a Combined Task Force in accordance with the Multinational Force Standing Operating Procedure. The U.S. Navy deployed ships from around the region to provide various types of relief. Carrier Strike Group 9, led by the USS Abraham Lincoln, and an Expeditionary Strike Group, led by the amphibious assault ship USS Bonhomme Richard (the USS Essex would later relieve the USS Bonhomme Richard), were all dispatched to render assistance. The Navy used these and other ships to support the effort. Both Navy and Marine helicopters flew missions carrying relief supplies to the needed areas. The U.S. Navy also provided a 1,000-bed hospital ship, the USS Mercy. The Air Force deployed C-5, C-17, and C-130 cargo aircraft from the region. Other militaries also deployed air and sea assets to the region. A lot of information was shared to make these deployments happen including orders, medical records, logistics, inventory reports, force deployment data, daily update briefings, weather and other pertinent information.

Table 4.3: Description of Phase II Deployment Activities for the Indian Ocean Tsunami

Tasks	**Data Types**
Organize task force	(S) Inputs from participating governments
Assign Units	(S) Force Deployment Document
Establish Lead Nation Authority	(S) Document identifying authority
Bureaucratic and Administrative	(S) Orders
Weather	(S) Forecast
Intelligence	(S) Daily reports
Medical	(S) Hospital reports, Mobile assets
Logistics	(S) Inventory, transportation reports

Daily Updates	(S) Daily Update Brief (DUB) format
Plan movement of supplies and personnel	(S) Orders

Phase III, Execute

The bulk of relief activities took place during the Execute Phase. The task force was set up so that all the partners had a common understanding and situational awareness of what activities were going on and to plan for future activities. The Combined Support Force set up a daily battle rhythm so that commanders and key decision makers could get the most recent information and when to expect it. This provided structure and reduces chaos. Information sharing was a key component to this battle rhythm. During the Operation Unified Assistance, there were two shift-change briefs per day running under 24-hour operations. It was at these briefs that information was transmitted to the incoming staff for updates and the current situational awareness. Meetings like these covered meteorological information and forecasts, personnel, intelligence, current operations, future operations, communications, NGO/IO updates, and reports as appropriate to the operation.

Table 4.4: Description of Phase III Execute Activities for the Indian Ocean Tsunami

Tasks	**Data Types**
Respond to RFIs	(S) Request For Information (RFI) Forms
Respond to RFAs	(S) Request For Assistance (RFA) Forms
Coordination of USAID Mission Tracking Matrix	(S) Mission Tracking Matrix (MITAM) – USAID OFDA
Current Ops Planning	(S) Operations Plan
Future Operations Planning	(S) Future Operations plan

Weather	(S) Forecast
Intelligence	(S) Daily reports
Daily Updates	(S) DUB format
Collect lessons learned	(S) Joint Lessons Learned Issue
IDP Camp Status	(S) Camp reports
Camp Commandant	(S) Staff Knowledge Management

Phase IV, Transition

It is in the Transition Phase, that the military transitions its responsibilities back to the relief agencies as they are able to do so, when the military is no longer needed. During the tsunami relief operation, the Pacific Air Force used metrics to measure the amount of supplies and passengers they were providing daily to help them forecast when they would no longer be needed. The World Food Program had huge cargo planes that could replace that requirement during the initial part of relief effort when the demand was so high. Also, the Indonesia government did not want the military responders in their country beyond 30 days. That help set a target of getting relief to the victims as quickly as possible and getting out. Lieutenant General Blackman, Commander of the III Marine Expeditionary Force and Commander of the JTF-536, was asked at the end of the operation if the military was going to conduct Cobra Gold, a multinational exercise conducted in Thailand every year. His response was “This is Cobra Gold”.

Table 4.5: Description of Phase IV Transition Activities for the Indian Ocean Tsunami

Tasks	**Data Types**
Current Ops Planning	(S) Op Plan
Future Operations Planning	(S) FUOPS plan

Transition Planning	(S) Transition Plan
Weather	(S) Forecast
Intelligence	(S) Daily reports
Daily Updates	(S) DUB format

Phase V, Redeployment

The Redeployment Phase is very much like the Deploy Phase. The units are now returning to their home station. This activity must be a coordinated phased approach to ensure all functions can be supported until the last unit leaves. In this phase, military units were sent back to their home stations to be re-assigned back to their steady state position. This phase was time sensitive for several reasons during Operation Unified Assistance. For those assigned to locations in Thailand including the CSF-536, there is a limit of 30 days in country without a visa. This rule put time pressure on those members who had to fly in through commercial aircraft unless they had a diplomatic passport. The other situation also involved the country that was most impacted by the tsunami, Malaysia. As mentioned, they gave the military 30 days to get in and out of Malaysia as part of the relief effort. The data required to redeploy members back to their home station is almost exclusively structured.

Table 4.6: Description of Phase V Redeployment Activities for the Indian Ocean Tsunami

Execute transition	(S) Transition Plan
Return to Home Station	(S) Transition Plan

The type of data that is shared across various phases does seem to change based on the phase of operation. Structured data was the most prominent data type used in the Deploy, Redeploy, and Transition Phases. These phases were characterized by their movement of resources, both manpower and material, to and from the disaster response site. So much of the data shared in this phase was quantitative and therefore tended to be more structured. The Assess phase was dominated by information that in many instances was unstructured. It was in this phase that information was being gathered and shared from many different sources. The data was gathered and aggregated in order to produce information that was actionable and so that informed decisions could be made. The remaining phases, (i.e., Prepare and Execute), used both structured and unstructured data. In the Prepare Phase, the military along with relief partners participated in activities where ideas were shared and discussed and where collaborative activities took place, such as conferences to discuss multinational agreements of operating procedures for humanitarian assistance and disaster response operations and for small scale contingencies, such as PACOM's Multinational Force Standing Operating Procedures conference held on an annual basis. Also, in this phase databases were being built and updated with information on critical resources and availability of those resources needed during the disaster. The databases contained information on hospitals and number of beds, and medical equipment, length and capacity of airfields, availability and size of ports, and other such data. This data was structured and could easily be accessed and analyzed when in this structured format. This fits closely to the Zigurs and Buckland's (1998) TTF theory which was adapted to fit the types of tasks necessary for foreign HA/DR events.

Table 4.7: Application of TTF Theory based on Phases of HA/DR Operations

Phases & (theory-based Task Types)	Date Types and Magnitude Compared to Expected. √ = as theoretically expected, ? = not as theoretically expected		
	Unstructured Data	Structured & Unstructured Data	Structured Data
I Assess (Simple)	√ High	√ None	√ Low
II Respond and VI Redeploy (Problem)	√ Low √ Low	√ Low √ None	√ High √ High
V Transition (Decision)	√ None	?? High	√ High
0 Prepare (Judgement)	√ High	√ None	?? High
IV Execute (Fuzzy)	√ Low	√ Medium	√ High

Process Support Levels

For this research, I have identified three process support levels to differentiate between decisions that support the strategic, operational and tactical plans and priorities of the United States. In this section, I describe how each of these process support levels functioned during the Indian Ocean tsunami foreign disaster response efforts of the U.S. military.

Strategic

For a multinational response such as this, strategic coordination must take place to ensure the governments understand their role and what they are requested to do. In situations where countries were not able provide the level of help that was required to meet the urgent needs they had to reach out to the government, through the U.S. Ambassador at the host country for assistance. Almost all of the data shared for strategic coordination was unstructured.

Operational

During a relief operation, task forces are set up to coordinate relief efforts from the strategic goal to the operational requirement to the tactical responders. The Joint Operations Centers were set up for that type of information exchange at the operational level. The Task Force for this event was a Combined Task Force (CTF) with 15 different militaries from around the world. The CTF was key to collaborating in such a wide spread operation. To coordinate these operations, there was a heavy reliance on structured data.

Tactical

Tactical level information was shared with and among units on the ground or providing naval or air support. Tactical level information allowed these units to do their required tasks and report operational objectives. The technology used to share tactical data information was balanced between technology platforms featuring unstructured and other technological platforms designed for structured data; however, there were also a few cases where a combination of data was shared across technology platforms simultaneously. A good example of this was the aerial photos provided by the U.S. Navy. They were essentially providing unstructured information until the Corps of Engineering geo-referenced the photos in a structured format that made sense and provided a larger operational picture.

Table 4.8 Relationship Between Process Support Levels and Data Sharing Magnitude

	Unstructured Data	Structured & Unstructured Data	Structured Data

Strategic	High	None	None
Operational	Low	Low	High
Tactical	Medium	Low	Medium

As displayed in Table 4.8, there does appear to be systematic differences in the type of data shared when taking into consideration the three process support levels. Unstructured data is dominant at the strategic level, perhaps because real-time data concerning on the ground conditions caused adaptive responses in strategy. The highest use of structured data occurred for operational activities. This also make sense since the U.S. military was the primary actor for these kinds of tasks and training exercises were opportunities to develop protocols for vetting and sharing pre-existing data about how tasks should be carried out. There was a mix of data types of tactical support. This is reasonable since the activities that were tactical were practiced in response, but also were adapted to the way the disaster response unfolded in-country.

Command Level

Since so many militaries worked together, it was essential to have a guiding document to operate together as a coalition, a team of teams. That document for the Pacific Area of Responsibility was the *Multinational Force Standing Operating Procedure*. This document helped facilitate a cohesive group when the disaster relief effort had contingencies that required assistance in the form of a coalition or combined task force. Information sharing was identified as being essential part of the combined operation and provided formats and procedures for sharing information.

If there is a multinational response in the Asia-Pacific Area of responsibility, where a military response is requested by the host nation or nations in the case of a regional disaster, then it is likely that a Multinational Combined Task Force will be formed. From a military perspective in the Asia-Pacific Area of Responsibility (AOR), the MNF SOP defined what this task force would look like and how it was executed. The staffs that were described in the MNF SOP were very closely aligned with the way traditional joint staffs are set up.

Personnel

The Indian Ocean Tsunami relief added an additional level of complexity for many different reasons. For example, the staff itself was a combined staff because it was multinational. The designation for this staff is C-1. If it had been a unilateral response from the United States only, it would have been set up as a Joint Task Force, rather than a Combined Task Force. For Operation Unified Assistance, the Combined Task Force, also referred to as the Combined Support Force, was set up at the Thai Royal Navy Base in Utapao, Thailand which had a very large capacity runway and tarmac and was excellent for use as a staging area for the relief effort.

Also, since this operation was taking place in a foreign country, the staff also had to be aware of bureaucratic requirements required of the host nation. For example, some of the members of the Combined Support Force arrived in country on tourist passports which had a limitation of 30 days. Some members were required to stay longer than this and required getting an exception so that there would be no problems at immigration upon departure.

These types of activities required coordination and information sharing so that these personnel situations could be addressed. We were fortunate as a country that English is fairly common in the region, but still translation was required where English was not spoken. Most of the data that the C-1 collected, monitored and shared was structured. Taking a look at the chart below, this fact becomes apparent.

Table 4.9 Information tracked by the C1 Staff

Information Requirement	FROM	TO	Battle Rhythm Schedule	FREQ	Classification	Priority	Reference
Lead & Participating Nations/Supported Strategic Comdr's/ National Command Elements Information Requirements							
Strategic Assessment	LPN/SSE	CCTF	Pre-D	Pre Mission	Classified	Medium	Part C, Ch 5
CCTF Estimates/ Assessments	CCTF	LN/SSC/NCE	Pre-D	Pre Mission	Classified	Medium	Part C, Ch 5
CCTF Mission Briefing	CCTF	LPN/SSC/NCE	Pre-D	Pre Mission	Classified	Medium	Part C, Ch 3, 5
CCTF Situation Reports/ Updates	CCTF	LPN/SSC/NCE	As per Battle Rhythm	Daily	Classified	Medium	Part C, Ch 3 Annex B
CCTF CCIRs (PIRs, FFIRs, EEFIs, etc)	CCTF	LPN/SSC/NCE		As Required	Classified	High	Part C, Ch 2
Request For Forces (RFF)	CCTF	LPN/SSC/NCE		As Required	Classified	Medium	Part B, Ch2; Part C, Ch 1
CCTF Public Affairs Guidance	CCTF	LPN/SSC/NCE		As Required	Classified	Medium	Part C, Ch 8, Annex C, App 2
CCTF After Action Reviews	CCTF	LPN/SSC/NCE	Post Mission	On Comd	Classified	Low	Part B, Ch 2, Annex B, Tab B

Table 4.9, from the MNF SOP, depicts the type of information the C1 tracked during multinational operations in accordance policies and procedures. Note that the information was tubular and structured.

Intelligence

During Operation Unified Assistance, intelligence information was shared with the entire Combined Support Force. This is mentioned since normally intelligence information is considered sensitive. In fact, the intelligence community has its own network. In the case of this relief operation however, intelligence information contained various, unclassified information that could be shared. This ability was extremely valuable to the task force when assessing the situation and developing courses of actions and plans. The III MEF intelligence office posted daily intelligence information on the Asia-Pacific Area Network.

Operations

Operations during Unified Assistance were no different. Important decisions were being made throughout the day and to make the most informed decisions, leaders needed good, timely, accurate information. A daily update brief to the commander is usually presented at the operational level. For example, the commander might take a briefing from the C-1 staff on the number of units he has at his disposal and what their expertise is. Then, he might get a brief from the C-2 on intelligence reports on the situation for his awareness. This might then be followed by briefs from the C-3 on current and future operations, which addresses immediate operational concerns (current operation) and a look a little further out (future operations). Logistics obviously is key to any operation and the C-4 would provide the commander with information on aircraft, ships, transportation capabilities to move personnel and equipment. The C-6 would provide the commander communications status around a broad range of communications assets, including in-country capabilities as well as satellite capabilities, ground, air and sea communications, and so on. It doesn't end there. Briefings are given to the commander from meteorological experts on current and projected weather in the area of operations, from the legal staff to ensure compliance with U.S. and international law, from other special staffs such as the chaplain's office and even the Camp Commandant if the CTF is large enough.

The key to all these briefs is that they have good actionable information that is concise, and which will help the commander and his staff to make decisions. The information shared during the Indian Ocean tsunami response was mostly structured since the data was quantitative. However, there was also a good share of unstructured data.

Logistics

During Operation Unified Assistance, frequent meetings, both formal and informal were held between the militaries involved in the operation and the Joint Logistic Agency representatives to plan for the logistics support based on priorities. The C-4 developed logistics plans and coordinated and supervised the supplies, maintenance, repair, evacuation, transportation, construction, and related logistics activities.

Plans

The Plans directorate was closely tied to the C-3 Operations because of its role to provide planning during a crisis operation. The two staffs work close together because these plans address the operations as they were being conducted.

Communications

Although a SIPRNET café was set up within the CTF-536 compound it was not the primary network used for communications. The primary means of communication was via commercial internet. Because of pre-established relationships with local communications providers for this type of service, the task force was able to set up commercial communications satellites on the compound to establish the needed communications environment. Because of this all partners participating in the operation had access. Although the military networks were also in place and operation they were not used nearly as extensively as the commercial network because of the domain restrictions of the military networks.

Partners

Partners are the organizations that were part of the relief effort and part of the CSF-536. These were organizations outside the U.S. Military organizations and include military, government, non-governmental, international, and regional/local organizations. Partners are examined as internal and external partners as described next.

Internal

During the relief effort the U.S. military established the Combined Support Force 536. Military partners from around the world made up the Combined Coordination Center within the CSF-536. The Center included interagency partners such as the State Department and USAID, Joint Logistic Agency and so on. The III Marine Expeditionary Group (III MEF) established the initial Joint Task Force, the JTF-536, and transitioned to CTF-536, as other countries were integrated. Later it was renamed as the Combined Support Force. The members of the original JTF-536, consisting of military members are considered to be the internal partners.

These are military organizations that made up the task force and information among these organizations that were also considered internal. Internal information sharing occurred on a regular basis through the CSF-536. Much of the information at the operational level, which occurred in the task force was structured and in many cases was quantifiable summary information to include information such as hospital availability and air field operations. This information was invaluable in providing situational awareness and giving the decision makers a better understanding in order to make informed decisions.

External

During Operation Unified Assistance, the United Nations (UN) Office for the Coordination of Humanitarian Affairs (OCHA) made use of their Virtual On-Site Operations Coordination Centre (OSOCC) which they use on a regular basis to assist in coordinating international relief efforts. The original concept was originally developed by OCHA and the International Search and Rescue Advisory Group network. UN OCHA deals with the response to natural disasters as part of their mission to "mobilize and coordinate effective and principled humanitarian action in partnership with national and international actors". During Operation Unified Assistance members of the CTF-536 had accounts set up with the UN OCHA Virtual OSOCC in order to exchange/share information to improve coordination and situational awareness. Exchange of information went both ways between the Virtual OSOCC and APAN's Virtual Information Center.

Another UN OCHA resource used during Operation Unified Assistance was Relief Web. Relief Web is a leading humanitarian information source on global crises and disasters used by many non-governmental and international organizations around the world. They provided reliable and timely information, enabling humanitarian workers to make informed decisions and to plan effective responses. They collected and delivered key information, including the latest reports, maps and infographics from trusted sources.

Because of the infamous Ring of Fire that causes havoc in the Asia-Pacific region and because of its volatile weather and other natural phenomena, natural disasters are unfortunately a common occurrence. There are some natural disasters that are large and complex enough that the country in which it occurs is not able to handle the relief efforts and must reach outside their own resources. At times, the government of the affected nation(s) in coordination with the ambassador to that country, the State Department, and USAID, and through USAID the U.S. military is asked to support the relief effort.

The U.S. military's Pacific Command's Asia-Pacific Area Network (APAN) communication system was used by the organizations within the combined task force to exchange information among the various and diverse organization. APAN allowed for coordination and collaboration among all nontraditional security partners, as well as non-military partners, who were key to the success of this enormous international relief effort.

The U.S. military's role extended beyond providing access to APAN. In addition, they were asked to coordinate, collaborate and provide situational awareness. APAN was set up as a regional security cooperation network along with other regional security cooperation networks such as America's Net in South America, Partnership for Peace Information Management System in Europe and Harmony Web in the Middle East Region. In order to gain efficiencies, reduce redundancies, and standardize some of the applications, the Asia-Pacific Area Network became the All Partners Assess Network with a global reach to address the same mission set and essentially become the Unclassified Information Sharing System for DoD worldwide.

Table 4.11 Type of Data Shared with Partners

	Unstructured Data	Structured & Unstructured Data	Structured Data
Internal	High	High	High
External	Low	Medium	High

Analysis of Data Sharing Activities

When analyzing the Indian Ocean tsunami relief effort, the Phases variable was the best predictor of the type of data that was shared. All the cells in the table were as predicted except for two cells. One cell was in the Transition phase which is a Decision Task. The theoretical expectation was that there would be a high percentage mix of structured and unstructured data; however, in this case, there was no mix of data with a 100 percent reliance on structured data. This was probably because the Transition phase has more concern with internal organizations turning over these tasks to the external organizations.

The second place where the case did not support the theory was during the Prepare phase. As a judgement task, it was expected that the use of structured data would be high. Instead, it included unstructured data as well. Databases to track training objectives prior to and during exercises, scenario events to be injected to the exercise to help the training audience to meet their training requirements, and other databases and spreadsheets that help planners to execute exercises were used. Also, intelligence gathered on airfield capacity to determine the type of aircraft that can land there, size of the tarmac, and other airfield related information to plan missions was provided to planners. Information was also gathered and stored on hospitals, what capabilities they have, the number of beds and other factors. All of this data are structured.

Level of support does not seem to be a good indicator, except for the Strategic level. At the Strategic level unstructured information sharing allowed the partners to have an open forum for the free flow of ideas and concepts. This facilitated the development of plans and policies. It also allowed for an unrestricted collaborative environment.

Command level was a good predictor of data shared for logistics and communications Structured data was expected, since the information they dealt with was quantitative. However, intelligence and operations data used a mix of data type, so this variable was not necessarily a good indicator for the type of data that was used. Plans were adapted in real time, but also contained data that was structured. Therefore, the command level was not determined to be a variable with strong explanatory power.

Internal versus external partners with whom information was shared, alone is not a strong predictor. However, when combined with the Phases variable, the ability to predict the type of data shared increases. For example, during Assess phase almost all data from external organizations was unstructured. Another example was during the Deploy phase where the internal organizations almost always dealt with structured data, such as flight manifests and plans.

Considering each of the four independent variables, the Phases variable offers the greatest support for the TTF theory as modified and applied to HA/DR. However, as shown in Table 4.12, there does seem to be a pattern from which one could argue that partners may be a mediating variable between the phases in which the military tasks are performed and the types of technology platforms used for sharing data. These findings will be triangulated based on the many lessons learned that came out of this relief operation. However, from the case data alone, we see a pattern suggestive of the intersection of tasks, partners and data sharing. This tentative finding will be explored in the following two chapters to see if it is idiosyncratic to the Indian Ocean case or whether there is a relationship that holds true in other settings and time periods.

Table 4.12 Provisional Identification of a Mediating Variable Relationship

Tasks by Phase	**Partners**	**Data Type**
Phase 0: Exercises Area Assessments Regional Engagements	Internal = High External = Medium	(U/S) Training objectives / databases (S) Airfield and Hospital studies (U) Exercises/port calls/meetings
Phase I: Damage Assessments Food and Shelter estimates Main Supply Routes Area Assessments	Internal = High External = High	(U) Damage Assessments (U) IDP Reports, NGO reports, Hospital reports (U) MSR reports from military units, civil authorities, populace (S) Airfield and Hospital studies
Phase II: Damage Assessments Food and Shelter estimates Main Supply Routes	Internal = High External = Low	(S) Organize task force (S) Assign Units (S) Bureaucratic and Administrative Requirements (S) Weather (S) Intelligence

		(S) Medical (S) Logistics (S) Daily Updates (S) Plan movement of supplies and personnel (S) Mapping (S) Ariel and ground photos
Phase III: Requests for Information (RFI) Requests for Assistance (RFA) Bureaucratic and Administrative Requirements Weather Intelligence Medical Logistics Daily Updates Plan movement of supplies and personnel	Internal = High External = High	(S/U) Respond to RFIs (S/U) Respond to RFAs (S) Coordination of USAID Mission Tracking Matrix (S) Current Ops Planning (S) Future Operations Planning (S) Weather (S/U) Intelligence (S/U) Daily Updates (S) Collect lessons learned (S) Mapping (S) Ariel and ground photos (U) Inputs from participating partners, interagency and international (S) Force Deployment Document (S) Orders (S) Forecast

		(S) Daily Reports (S) Hospital reports (S) Mobile assets (S) Inventory (S) transportation reports (S) DUB format (S) Orders
Phase IV Current Ops Planning Future Operations Planning Transition Planning Weather Intelligence Daily Updates	Internal = High External = Medium	(S) Op Plan (S) FUOPS plan (S) Transition Plan (S) Forecast (S) Daily Reports (S) DUB Format
Phase V Execute transition Return to Home Station	Internal = High External = Low	(S) Transition Plan

Chapter Summary

The Indian Ocean case study offers excellent examples of the sharing of data between disparate group of organizations working together toward a common goal of disaster relief. Through case analysis, we are able to provide provisional answers to the research questions.

- Research Question #1: What are the types of data shared by the U.S. military in HA/DR events?

The last table in this chapter visually demonstrated the high reliance on structured data by U.S. military organizations that were providing humanitarian assistance/disaster relief on the heels of the 2004/2005 Indian Ocean tsunami which had such devastating effects on people and property in the region.

- Research Question #2: What is the relative fit between the Task variable and the types of data shared by the U.S. military in HA/DR events?

It does appear that the use of the Phases variable to represent tasks gives good insight into what types of data sharing technology platforms were used. Therefore, as I predicted in Chapter Two, the adapted model of the fit between task and technology is a good predictor of the technology platforms that the U.S. military uses in foreign disaster relief activities.

- Research Question #3: Are there other factors, such as Process Support Level, Military Command and/or Partners, that provide a more robust explanation of the types of data shared during the activities of the U.S. military in HA/DR events?

When analyzing the Indian Ocean tsunami case, I found that the partner variable offers strong explanatory power as a mediating variable. There is also some explanatory power found in the process support level. In the next chapter, a second case study is described and analyzed to provide a basis for comparing the patterns between variables suggested by this case. The use of structured data was as expected. However, the sharing of unstructured data was significantly less than predicted and the combination approach for sharing structured and unstructured data was used sparingly.

CHAPTER FIVE

THE 2010 HAITI EARTHQUAKE

In 2011, United States Navy Lieutenants Clayton Beas and Brian Lysne, authored an investigative report on inter-organizational collaboration during the Haiti Relief effort. This report discussed that Asia-Pacific Area Network and how it had been successful as a tool for support of the U.S. military command in meeting information exchange and collaboration needs and supporting the regional security cooperation requirement sin the Asia-Pacific region since March 2000. Ten years later, the name was changed from the Asia-Pacific Area Network to the All Partners Access Network (APAN). The name change reflects a shift that made APAN a global resource to support regional security needs around the world. Beas and Lysne's concluded that during the Haiti relief efforts APAN "proved useful in bringing together many aid groups, including several U.S. government entities, to effectively address Haiti's needs." (Beas and Lysne, 2011, p. v).

Five years after the Indian Ocean tsunami that was generated by a massive 9.0 earthquake off the coast of Sumatra, Indonesia, another natural disaster occurred on the island nation of Haiti. On January 20, 2010, an earthquake with an epicenter 16 miles west of the Haitian capital of Port-au-Prince devastated the island nation. Over 200,000 lives were lost and as many as 1.5 million were displaced. In addition, there was massive property and infrastructure damage. There are many similarities between these two natural disasters even though they occurred five years apart. One similarity is the level of devastation and need for disaster relief and humanitarian assistance to be provided by foreign partners.

Since the response was beyond the capabilities of the Haiti nation acting alone, the U.S. and other military organizations, as well as non-government and international organizations quickly responded to fill resource gaps. This chapter explores how data was shared during the foreign disaster response efforts through description of the different response phases, process support levels, military command and partners in the U.S. military's HA/DR response to the Haiti earthquake.

Phases in the 2010 U.S. military Haiti Earthquake HA/DR Response

The Haiti earthquake required a similar response as Indian Ocean tsunami. The phases of the HA/DR relief efforts were very similar to those described for the Indian Ocean tsunami. In this section, I describe the U.S. military tasks as part for the foreign disaster response.

Phase 0, Prepare

The Prepare Phase is a way for military planners to shape the environment by planning and practicing how the U.S. military will respond to natural disasters. Planning and exercises allow organizations, often from multiple countries, to get "on the same page" about what needs to be coordinated during a natural disaster, then decide, practice and plan how they are going to work together, even though the disaster context in which they will work together is unknown.

SOUTHCOM, the U.S. Southern Command, a joint command whose area of responsibility covers Haiti, is not a stranger to natural disasters. They regularly conduct major military exercises to practice the processes, procedures, and tactics used to coordinate during a response all in the name of preparation. Two of the major exercises SOUTHCOM conducts are Fuerzas Aliadas Humanitarius, and Trade Winds. Both are multinational exercises, and each has a humanitarian assistance/disaster relief component.

In an odd coincidence, the day prior to the Haiti earthquake, the Defense Information System Agency (DISA) was at SOUTHCOM for the test of the Transnational Information Sharing Cooperation (TISC) project which simulated information systems in case of a major emergency relief in Haiti. APAN was a major component of the TISC. APAN's new technology platform went "live" in support of the relief operation, essentially going from a Phase 0 event to a Phase I in just a matter of days. This was a time where APAN was beginning to replace the regional cooperation networks and begin its global reach.

Another example of Phase 0 activities is the Medical Readiness Training Exercises conducted by SOUTHCOM. In 2006, USSOUTHCOM sponsored 69 Medical Readiness Training Exercises in 15 nations, providing medical services to more than 270,000 citizens from the region (https://en.wikipedia.org/wiki/United_States_Southern_Command, 2018). Table 1 shows these activities and the data types that would be shared.

Table 5.1: Description of Phase 0 -Preparation Activities for the Haiti Earthquake

Task	**Data Types**
Exercises	(U/S) Training objectives / databases
Area Assessments	(S) Airfield and Hospital studies

Phase I, Assess

The Joint Research Centre (JRC) used the Global Disaster Alert and Coordination System (GDACS), which is a web-based platform developed by the JRC and the United Nations. The system was able to detect the first shock and issued an alert to 8,500 aid and first response organizations.

World Vision also produced a rapid assessment which was carried out both in the greater Port-au-Prince area, as well as out in the countryside where World Vision worked. This report was made available to relief organizations to help provide action information for the relief actors.

The United Nations used several different web portals/platforms managed by the United Nations – Office of Coordination of Humanitarian Assistance (UN-OCHA) to monitor the relief situation following the earthquake they included the:

- Global Disaster Alert and Coordination System (GDACS)
- Virtual On-Site Operations Coordination Center (VOSOCC)
- ReliefWeb
- One Response

While the Global Disaster Alert and Coordination System issued alerts to first responders, the VOSOCC was used to help mobilize and coordinate deployment of United Nations Disaster Assessment Coordination Teams to Port-au-Prince. The OneResponse portal developed by UN OCHA was one of the technology platforms, along with ReliefWeb to share data, information, and analysis related to clusters, which were groups of humanitarian organizations and designated by the Inter Agency Standing Committee. Figure 5.1 is a graphic developed by UN OCHA providing example of clusters that would be expected in a HA/DR disaster response.

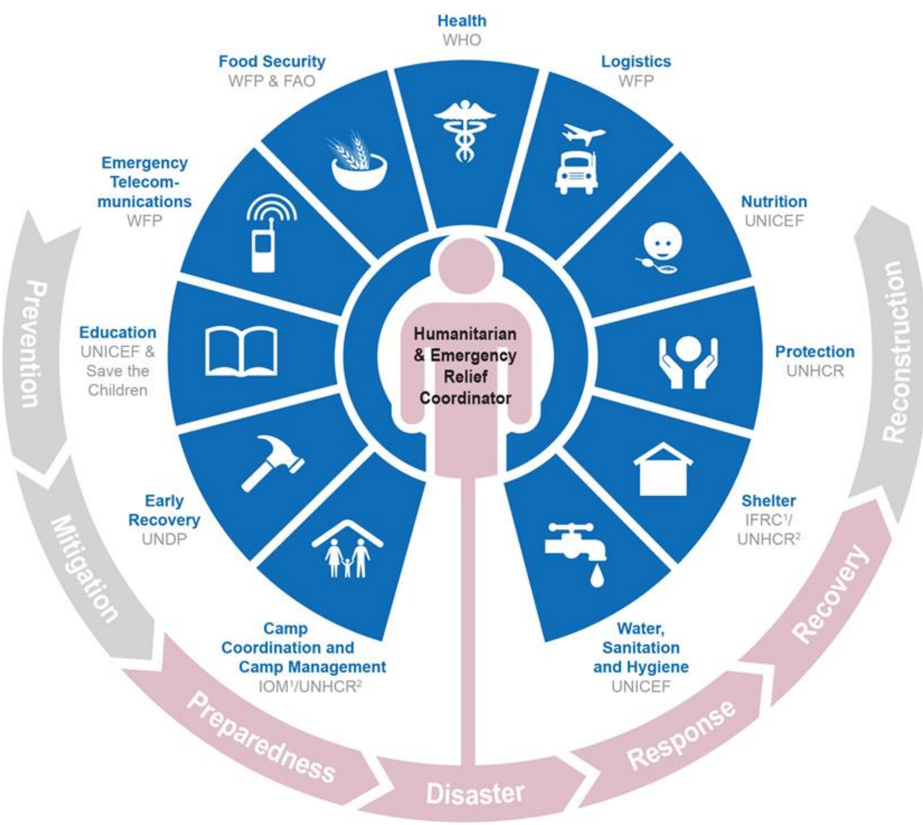

Figure 5.1 United Nations Disaster Response Clusters of Responding Organizations

There were other information management tools used to help to facilitate humanitarian coordination and collaboration. They included:

- GoogleGroups
- The Joint Operations Tasking Center (JOTC) logistics form
- Who is Doing What Where (3W) database
- Multi-Cluster Rapid Assessment Methodology
    - Displacement Tracking Matrix, Post Disaster Needs Assessment and Recovery Framework
    - Cluster Meeting calendar and directories

The APAN was used as an information sharing portal as well. This web-based platform provided as a resource for information sharing among and relief organizations, governmental and non-governmental as well as the military. APAN was not only a repository of data but the database also supported collaborative technologies such as web-based chat, video, file sharing, forums and a one stop location of links to other information products the others host. Access to APAN was critical since it was a centralized technology platform from which the relief actors, both military but also non-military could share and exchange information to get a more complete picture of the situation on the ground. This allowed decision makers and planners to make plans based on the real-time situation.

A posting on APAN's website gives an excellent example of how this technology allowed for data sharing to the broader relief organization community. If this resource solution had not been found, the relief efforts would have been hampered.

> *For instance, the Hospital Sacre Coeur in Milot, Haiti was unaffected by the earthquake. It was equipped with a full staff along with 73 available beds, yet*

four days after the initial earthquake, the hospital had only six patients. Personnel at the hospital used the community to post a message stating beds were available; shortly after, patients started to arrive. Within a week from posting on the Haiti HADR Community, the hospital staff treated nearly 250 severely injured people.

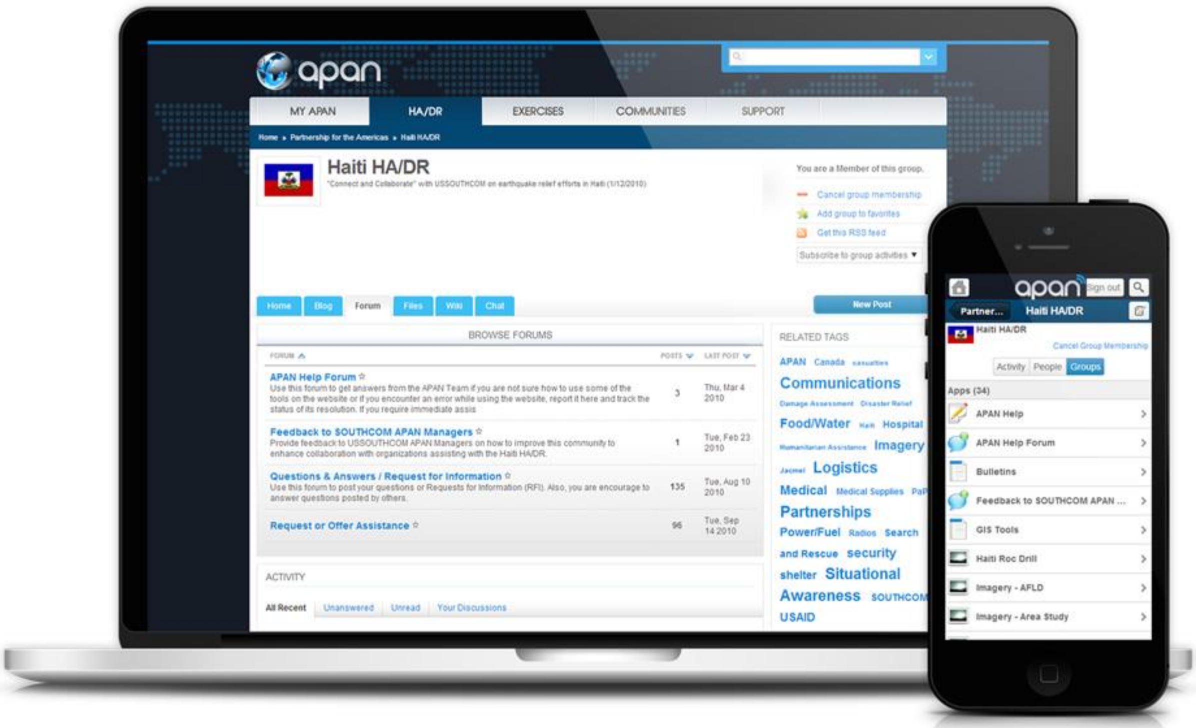

Figure 5.2 Example of the APAN Portal for Multiple Technologies

This was not the first time APAN has been used for this type of tactical level application. It was used on numerous other occasions. The first documented use of APAN was from the Philippines when the Civil Affairs group reached out to the community worldwide in 2000. Knights Bridge, an NGO, submitted a request for assistance through APAN for a prosthetic leg for a soldier from the Philippines who had severely injured his leg. Within 24 hours they had a donor from the west coast. Table 5.2 recaps data sharing in Phase I.

Table 5.2: Description of Phase I -Assessment Activities for the Haiti Earthquake

Task	**Data Type**

Damage Assessments	(U) Damage Assessments
Food and Shelter estimates	(U) IDP Reports, NGO reports, Hospital reports
Main Supply Routes	(U) MSR reports from military units, civil authorities, populace

Phase II, Respond

Taken from a military perspective, during the respond phase, personnel staff manage manpower resources and administration, develop personnel policies, administer military and civilian personnel from all nations participating within the CTF. Table 5.3, from the MNF SOP, depics the type of information the C1 tracked during the a multinational operation in accordance policies and procedures. Note that the information is tublar and structured. A lot of this information must be closely held in a disaster response since it deals with sensitive issues related to troop strength and movement and to protect the privacy of individuals. This information was for command and control and was shared only on closed networks.

Table 5.3 Information tracked by the C1 Staff

Information Requirement	FROM	TO	Battle Rhythm Schedule	FREQ	Classification	Priority	Reference
Lead & Participating Nations/Supported Strategic Comdr's/ National Command Elements Information Requirements							
Strategic Assessment	LPN/SSE	CCTF	Pre-D	Pre Mission	Classified	Medium	Part C, Ch 5
CCTF Estimates/ Assessments	CCTF	LN/SSC/NCE	Pre-D	Pre Mission	Classified	Medium	Part C, Ch 5
CCTF Mission Briefing	CCTF	LPN/SSC/NCE	Pre-D	Pre Mission	Classified	Medium	Part C, Ch 3, 5
CCTF Situation Reports/ Updates	CCTF	LPN/SSC/NCE	As per Battle Rhythm	Daily	Classified	Medium	Part C, Ch 3 Annex B
CCTF CCIRs (PIRs, FFIRs, EEFIs, etc)	CCTF	LPN/SSC/NCE		As Required	Classified	High	Part C, Ch 2
Request For Forces (RFF)	CCTF	LPN/SSC/NCE		As Required	Classified	Medium	Part B, Ch2; Part C, Ch 1
CCTF Public Affairs Guidance	CCTF	LPN/SSC/NCE		As Required	Classified	Medium	Part C, Ch 8, Annex C, App 2
CCTF After Action Reviews	CCTF	LPN/SSC/NCE	Post Mission	On Comd	Classified	Low	Part B, Ch 2, Annex B, Tab B

There were many and varied military units that deployed as part of Operation Unified Response and all had to management and track the personnel and resources that would be involved. The following are some of the units that were part of the operation:

- United States Coast Guard cutters
    - USCGC Forward (WMEC-911)
    - USCGC Mohawk (WMEC-913)
- USCGC Valiant (WMEC-621)
- USCGC Tahoma (WMEC-908)
- U.S. Navy
    - Destroyer USS Higgins (DDG-76).
    - USS Carl Vinson (CVN-70)
    - USNS Comfort (T-AH-20)
    - USS Underwood (FFG-36)
    - USS Normandy (CG-60)
    - USS Bataan (LHD-5)
    - USS Carter Hall (LSD-50)
    - USS Fort McHenry (LSD-43)
    - USS Bunker Hill (CG-52)
    - USCGC Oak (WLB-211)
    - USNS Grasp (T-ARS-51)
    - USS Gunston Hall (LSD-44)
    - USS Nassau (LHA-4)
    - USS Mesa Verde (LPD-19)
    - USS Ashland (LSD-48)
    - USNS Henson (T-AGS-63)
- United States Air Force
- Special Operations MC-130H Combat Talon II
- United States Air Force Special Operations
- 260th Air Traffic Control Squadron (ATCS)
- 248th ATCS
- 258th ATCS
- United States Marines
- 22nd Marine Expeditionary Unit from Marine Corps Base Camp Lejeune
- 24th MEU
- United States Army
- XVIII Airborne Corps HQ
- 82nd Airborne Division

- National Guard
    - 190th Civil Engineering Squadron of the Kansas Air National Guard
    -

Table 5.4: Description of Phase II -Deployment Activities for the 2010 Haiti Earthquake

Task	**Data Type**
Organize task force	(S) Inputs from participating partners
Assign Units	(S) Force Deployment Document
Bureaucratic & Administrative	(S) Orders
Weather	(S) Forecast
Intelligence	(S) Daily reports
Medical	(S) Hospital reports, (S) Mobile assets
Logistics	(S) Inventory, (S) transportation reports
Daily Updates	(S) DUB format
Plan movement of supplies and personnel	(S) Orders

Phase III, Execute

The Joint Task Force – Haiti was set up by SOUTHCOM under the command of General Keen from SOUTHCOM. It was decided not to set up a combined task force similar to the Combined Task Force set up as part of the Indian Ocean relief effort. However, the Joint Task Force – Haiti did work in close coordination with the already established United Nations Stabilization Mission in Haiti peacekeepers.

Table 5.5: Description of Phase III - Execute Activities for the 2010 Haiti Earthquake

Task	**Data Type**
Respond to RFIs	(U) RFI
Respond to RFAs	(U) RFA
Coordination of USAID Mission Tracking Matrix	(S) MITAM
Current Ops Planning	(S) Op Plan
Future Operations Planning	(S) FUOPS plan
Weather	(S) Forecast
Intelligence	(S) Daily reports
Daily Updates	(S) DUB format
Collect lessons learned	(S) Joint Lessons Learned Issue
IDP Camp Status	(S/U) IDP Camp Updates

The following highlight a few of the key contributions that JTF-Haiti made during the response and recovery time periods (U.S. Joint Forces Command, 2010):

- Evacuated 16,412 U.S. citizens
- Medically evacuated 343 patients
- Delivered more than 2.6 million liters of water
- Delivered 17 million lb. of bulk food
- Delivered 5.7 million individual meals or rations
- Conducted more than 1,000 surgeries
- Treated more than 9,000 patients
- Provided emergency shelter for 1.7 million people
- Cleared 12,274 cubic yards of rubble
- Assessed the structural integrity of more than 25,000 buildings and homes
- Reopened the airport to operations enabling the delivery of 36 tons of emergency relief supplies and equipment
- Assisted in reopening docking facilities enabling the delivery of more than 8,000 shipping containers

Phase IV, Transition

Coordination with the USAID and the NGO/IO community was critical for the smooth transition of relief efforts back to the civilian sector. The military's role wound down as the initial relief needs are met and the unique capabilities and resources of the military were no longer needed. This was a coordinated effort that relieved the military of future tasks.

As we see this transition occurring, we see our civilian partners increase their capabilities -- both the government here in Haiti as well as the non-government organizations -- we see the need for our military assistance dwindling," said Keen. "However, at the present time, there is still great need across the board. And we still remain decisively engaged providing critical assistance".

(US Haiti Relief Effort in Transition to Civilian Phase, https://www.voanews.com/a/haiti-relief-effort-transition-civilian-phase-84630552/163804.html, p. 1)

Figure 5.3 U.S. Army special forces Lt. General Kenneth Keen (L) with a refugee family in a makeshift shelter camp near the Presidential palace in Port-au-Prince (File) (source).

Table 5.6: Description of Phase IV -Transition Activities for the 2010 Haiti Earthquake

Task	**Data Type**
Current Ops Planning	(S) Op Plan
Future Operations Planning	(S) FUOPS plan
Transition Planning	(S) Transition Plan
Weather	(S) Forecast
Intelligence	(S) Daily reports
Daily Updates	(S) DUB format

Phase V: Redeploy

This phase is very much like the Respond page except now the relief team was returning to their home stations or reassigned them to other areas as needed. The transition plan that supported the Phase V Redeployment activities relied on structured data (See Table 5.7).

Table 5.7: Description of Phase V - Redeployment Activities for Haiti Earthquake

Task	Data Type
Execute transition	(S) Transition Plan
Return to Home Station	(S) Transition Plan

The type of data shared across various phases did seem to change during the Haiti earthquake response based on the tasks of the U.S. military in each phase. Structured data was the most prominent data type used in the Deploy Phase, the Redeploy Phase, and the Transition Phase. These phases were characterized by their movement of resources, both manpower and material, to and from the humanitarian assistance and disaster relief. So much of the data shared in this phase was quantitative, and therefore tended to be more structured. The Assess phase was dominated by information that in many instances was unstructured. It is in the phase that information was being gathered and shared from many different sources. The data was aggregated to produce information that was actionable and allowed informed decision making.

The remaining phases, (i.e., Prepare and Execute), used both structured and unstructured data. In the Prepare Phase the military, along with relief partners, participated in activities where ideas were shared and discussed and where collaborative activities, such as conferences set up to discuss multinational agreements of operating procedures for humanitarian operations and small-scale contingencies, took place. Also, in this phase databases were being built and updated with information on critical resources and the availability of those resources during a disaster. The databases contained information on hospitals and number of beds, and medical equipment, length and capacity of airfields, availability and size of ports, and other such data. This data was structured and could easily be accessed and analyzed. Table 5.8 provides recaps of the findings for task activities by phase and the type of data that was shared during the Haiti earthquake humanitarian assistance and disaster relief efforts. Reviewing the cells in this table, there are only two cells, the used a mix of data in the transition phase and the high use of structured data in the Prepare phase, that challenge the adaptation of Zigurs and Buckland (1998) Task and Technology Fit theory.

Table 5.8: Application of TTF Theory based on Phases of HA/DR Operations

Phases & (theory-based Task Types)	Date Types and Magnitude Compared to Expected. √ = as theoretically expected, ? = not as theoretically expected		
	Unstructured Data	Structured & Unstructured Data	Structured Data
I Assess (Simple)	√ High	√ None	√ Low
II Respond and VI Redeploy (Problem)	√ Low √ Low	√ Low √ None	√ High √ High
V Transition (Decision)	√ Low	?? None	√ High
0 Prepare (Judgement)	√ High	√ None	?? High
IV Execute (Fuzzy)	√ Low	√ Medium	√ High

Process Support Levels

The three levels of support examined in this research are associated with the organization as it is related to their role whether be it strategic, operational, or tactical. The Strategic level of support shared data among organizations responsible for the national interests, policy making and strategies during the Haiti earthquake response. The operational level connected command level goals to the details forwarded to the tactical units that carried out the strategy. The specific types of data that were shared for each of these three levels is shown in Table 5.9.

Table 5.9 Data Types based on Level of Support

Level	**Data Types**
Strategic Operational Tactical	(U/S) Joint Exercise Life Cycle Outputs
Strategic Operational	(U) Multinational Agreements /MOUs
Operational	(U) Damage Assessments IDP Reports NGO reports Hospital reports MSR reports (S) Joint Exercise Life Cycle Outputs Inputs from participating partners, interagency and international Force Deployment Document Document identifying authority Orders Forecast Daily reports Hospital reports, Mobile assets Inventory, transportation reports DUB format MITAM Op Plan FUOPS plan Joint Lessons Learned Issue Op Plan Transition Plan Forecast

	(S/U) RFI (S/U) RFA
Tactical	(S/U) Joint Exercise Life Cycle Outputs

Strategic

Strategic messaging was important in informing the public of the relief efforts and the collaborative environment in which the relief operation was being conducted. This was especially true since the U.S. military was part of the operation and played a non-traditional role coordinating with other relief partners. Much of the information sharing at the strategic level came from training exercises and multinational strategic engagements with partner nations in the region of which SOUTHCOM was a part. Most all of the information exchanged was at the operational level and covered all phases. The sharing of information allowed the partners to make decisions together based on the situation. It also facilitated the giving of directions to the tactical units to execute their techniques and procedures.

Information sharing at the strategic level was usually unstructured. This allowed the partners maximum flexibility to share information regardless of the format. It also allowed for an open exchange of ideas, especially during engagement events where stakeholders discussed options in an open, collaborative environment. A good example of this was bi-lateral and multilateral conferences on topics ranging from medical to communications issues.

Operational

At the operational level, the data was sometimes shared in a structured format, other times in an unstructured format and sometimes in both formats. One example of structured data was the Mission Tracking Matrix (MITAM) used by the Office of Foreign Disaster Assistance (OFDA). This spreadsheet allowed OFDA to validate and prioritize requests for assistance and then assign to the appropriate force. Unstructured data included inputs from sources outside the task force such as from an NGO, or first responder, in the form or an email, phone call, meeting, etc. that contained pertinent information to the decision makers at the operational level. A combination of structured and unstructured data was a request for information in a format that had defined fields for specific information and along with free form fields that allowed the user to explain the situation and give details without the restriction of a formatted response.

Tactical

The tactical level of information sharing was limited to the Execute Phase. Tactical level information sharing included providing information that allowed organizations to organize and execute task together. An example was the sharing and management of emergency frequencies to ensure there was no conflict and so everyone had situational awareness of real time activities.

The information sharing based on the level of support in Haiti matches well with the Indian Ocean relief effort five years prior (see Table 5.10). Many the processes and organizational structures changed little in those years. The technology platforms to perform procedures and the procedures had minimal changes, mostly to facilitate these relief operations.

Table 5:10 Analysis of Data Types by Level of Support for the Haiti Earthquake

Level of Support	Date Types and Magnitude Compared to Expected. √ = as theoretically expected, ? = not as theoretically expected		
	Unstructured Data	Structured & Unstructured Data	Structured Data
Strategic	√ High	√ None	√ Low
Operational	√ Low	√ Low	√ High
Tactical	√ Medium	√ Low	√ Medium

Command Level

As predicted in the Chapter Two introduction, a task force was formed for the military's disaster response. Named the Joint Task Force – Haiti , it was set up with six primary command functions and one specialized function, Medical. Descriptions of the activities and types of data shared by each command function follows:

Personnel

Personnel command functions operated in an information environment that favored structured data. This allowed the personnel staff to management personnel and resources. Most of the information was related to the personnel assigned to executing the mission. This information was sensitive, and in many cases classified to protect the privacy of the individual as well as the participating unit.

Intelligence

Intelligence information was unstructured and structured and as well as a mix. Intelligence was gathered from a plethora of sources and assimilated and analyzed regardless of the format. The aerial photos provided by both military and civilian aircraft and satellite systems were unstructured in the way they were "posted" but most of the partners already used a common data format to allow them to be displayed. The mapping data also was provided in a format such that the mapping application could read and properly display the maps.

Operations

The operations command function was primarily structured, and mixed data was part of the information sharing environment. For example, there was a pre-defined format for an Operations Order given to the subordinate units to perform their mission. This represents a structured format, but the data itself can be unstructured. Fragmentary Orders were, on the other hand, very specific and followed a specific Message Text Format for the data that was entered.

Logistics

The logistics command function almost exclusively dealt with structured data. It was mostly concerned with size, quantity, location, costs, requirements of resources for the relief effort, all of which tended to be quantitative values. The World Food Program (WFP) was the Logistics Cluster lead. The WFP had databases which they updated about where, when and how best to deliver the aid that is essential.

Plans

Closely aligned with the operations command function, the planning command function favored more of a hybrid data information sharing environment. Current and future operations planning helped the planners to communicate the strategy into that operational plans that the tactical units executed.

Communications

Communications in many ways was similar to logistics in that all information had to be accurate to be effective. Emergency frequencies were managed to keep lines of communications opened to first responders. Communications had to be interoperable so that all partners could communicate. Even the data required for azimuths had to be accurately set up for satellite connectivity. As one can see in Table 5.11 Almost all of the data used by the Communications command level was quantitative, therefore structured.

Table 5.11 Data Types based on Command Level

Task	**Command Level**	**Data Structure**
Phase 0: Exercises Area Assessments Regional Engagements	Operational Tactical	(U/S) Training objectives / databases (S) Airfield and Hospital studies (U/S) Training objectives / databases
Phase I: Damage Assessments Food and Shelter estimates Main Supply Routes Area Assessments	Operational Tactical	(U) Damage Assessments (U) IDP Reports, NGO reports, Hospital reports (U) MSR reports from military units, civil authorities, populace (S) Airfield and Hospital studies
Phase II: Organize task force Assign Units Bureaucratic and Administrative Requirements Weather Intelligence Medical Logistics Daily Updates Plan movement of supplies and personnel	Operational Tactical	((S) Inputs from participating partners, interagency and international (S) Force Deployment Document (S) Orders (S) Forecast (S) Daily reports (S) Hospital reports (S) Mobile assets (S) Inventory (S) transportation reports (S) DUB format (S) Orders
Phase III: Bureaucratic and Administrative Requirements Weather Intelligence Medical Logistics Daily Updates Plan movement of supplies and personnel Current Ops Planning Future Operations Planning	Operational	(S) Inputs from participating partners, interagency and international (S) Force Deployment Document (S) Orders (S) Forecast (S) Daily Reports S) Hospital reports (S) Mobile assets (S) Inventory (S) transportation reports (S) DUB format (S) Orders (S) Op Plan (S) FUOPS plan
Phase IV: Current Ops Planning Future Operations Planning Transition Planning Weather Intelligence Daily Updates	Operational	(S) Op Plan (S) FUOPS plan (S) Transition Plan (S) Forecast (S) Daily Reports (S) DUB Format

Phase V: Execute transition Return to Home Station	Operational	(S) Transition Plan

Partners

For the Haiti earthquake foreign disaster response, partners came together to support a common goal of providing relief and saving lives. Even though the traditional role of the U.S. military is to provide such assistance with both manpower, equipment and material resources unless they are called upon to provide more immediate security responses. In the context of sharing information with partner internal organizations were the organizations with which the U.S. military normally does business. External organizations were the organizations that normally had no need to share information. Further details on specific partners follows.

Internal Partners

During the relief effort the U.S. military established the Joint Task Force – Haiti (JTF-Haiti). It consisted of:

- Joint Force Land Component Command
- Joint Logistics Command
- Joint Task Force – Port Opening
- Joint Force Maritime Component Command
- Air Force Maritime Component Command
- Joint Force Special Operation Component Command

These were all military organizations on the task force and information occurred on a regular basis through the Joint task Force – Haiti. Much of the information shared with these internal partners, was structured. In many cases, the data were quantifiable summaries to include information such as port operations as well as air field operations. This information was invaluable in providing situational awareness and giving decision makers a better understanding in order to make informed decisions.

Table 5.12 Data Type based on Type of Partner

Task	Relative # of Partners	Data Type
Phase 0: Exercises Area Assessments Regional Engagements	Internal = High External = Medium	(U/S) Training objectives / databases (S) Airfield and Hospital studies (U) Exercises/port calls/meetings
Phase I: Damage Assessments Food and Shelter estimates Main Supply Routes Exercises Area Assessments	Internal = High External = High	(U) Damage Assessments (U) IDP Reports, NGO reports, Hospital reports (U) MSR reports from military units, civil authorities, populace (U/S) Training objectives / databases (S) Airfield and Hospital studies
Phase II: Damage Assessments Food and Shelter estimates Main Supply Routes	Internal = High External = Low	(S) Organize task force (S) Assign Units (S) Bureaucratic and Administrative Requirements (S) Weather (S) Intelligence (S) Medical (S) Logistics (S) Daily Updates (S) Plan movement of supplies and personnel (S) Mapping (S) Ariel and ground photos
Phase III: Requests for Information (RFI) Requests for Assistance (RFA) Bureaucratic and Administrative Requirements Weather Intelligence	Internal = High External = High	(S/U) Respond to RFIs (S/U) Respond to RFAs (S) Coordination of USAID Mission Tracking Matrix (S) Current Ops Planning (S) Future Operations Planning (S) Weather (S/U) Intelligence (S/U) Daily Updates

Medical Logistics Daily Updates Plan movement of supplies and personnel		(S) Collect lessons learned (S) Mapping (S) Ariel and ground photos (U) Inputs from participating partners, interagency and international (S) Force Deployment Document (S) Orders (S) Forecast (S) Daily Reports S) Hospital reports (S) Mobile assets (S) Inventory,(S) transportation reports (S) DUB format (S) Orders
Phase IV Current Ops Planning Future Operations Planning Transition Planning Weather Intelligence Daily Updates	Internal = High External = Medium	(S) Op Plan (S) FUOPS plan (S) Transition Plan (S) Forecast (S) Daily Reports (S) DUB Format
Phase V Execute transition Return to Home Station	Internal = High External = Low	(S) Transition Plan

External Partners

There were reportedly over 1,000 NGOs working with the UN Office of Coordination of Humanitarian Assistance (OCHA) that participated in this relief effort. These organizations are the partners that were considered external. During Haiti, most of the information among these organizations was shared across all phases and command functions in unstructured data formats, with few exceptions such as the USAID MITAM and summary reports from WFP of critical food delivery.

Knowing more about the internal and external partners improved the explanatory power of the Phase variable. For internal partners, structured data was used primarily in the Respond, Transition, and Redeploy phases. The unstructured data tended to be shared with internal partners during the Prepare and Assess phases. However, for the external partners, structured data was shared primarily in the Execute phase with a low reliance on unstructured data the remainder of the time.

There were other non-traditional technologies that emerged during the relief effort that played a critical role. In fact, they were primarily efforts by volunteers which received quite a bit of notice from the leveraging of Web 2.0 technologies to provide critical information.

Within hours after the report of the Haiti earthquake, a new community of virtually connected volunteers affiliated with Information and Communications Technology (ICT) consulting companies, private corporations, open source software proponents, academic/research institutions, NGOs, and even the Haitian diaspora community began applying new ICT applications to the earthquake response. "Web 2.0" social network media were used as a new means for crowdsourced data collection, information sharing, and collaboration. Within days, individuals from this community, with support from the U.S. State Department, worked with ICT companies to establish a SMS 4636 code for the free transmission of text message information to and from Haiti. Google adapted its suite of tools for applications to support the Haiti earthquake response and helped develop a Person Finder application to help find and connect persons in Haiti who could not be contacted.

A nascent, virtual CrisisMappers network began utilizing an open source interactive mapping platform, known as Ushahidi (Swahili for “witness”), to gather, extract, and plot geo-referenced data on a public domain website. Over the course of the disaster, Ushahidi and volunteer translators received over 80,000 text messages; approximately 3,000 of these were used in some way during response activities. Other geo-referenced data were gleaned from Twitter, blogs, the news media, and humanitarian situation reports to provide fast turnaround situational awareness products, including imagery-based maps. The U.S. Coast Guard, the 22nd U.S. Marine Expeditionary Unit, and other first responders reported using these social media platforms to carry out their emergency assistance operations. Individuals from the USG, the UN, and some NGOs were also connected to this network.

Chapter Summary

The 2010 Haiti earthquake case offers insight into the way the U.S. military responded to this foreign disaster. A review of this case reveals similar patterns to what was discovered in the Indian Ocean tsunami event; however, there are some nuanced differences. For example, a slight shift to more unstructured data for all of the independent variables is evident. I close the chapter by answering the three research questions.

- Research Question #1: What are the types of data shared by the U.S. military in HA/DR events?

For the Haiti Earthquake case, the U.S. military relied on technology platforms that featured structured data and unstructured. Structured data was shared with internal partners and often for strategic process support. Unstructured data, rather than being generated by the U.S. military was created by a network of volunteer responders and used by the U.S. military.

- Research Question #2: What is the relative fit between the Task variable and the types of data shared by the U.S. military in HA/DR events?

The phases are the best predictor of the type of data that was shared. All the cells in the table were as predicted except for two cells. First, in the Transition phase which is Decision

Task. The theoretical expectation was that there would be a high percentage mix of structured and unstructured data; however, in this case, there was no mix of data with nearly a 100% reliance on structured data. This was probably because the Transition phase has more concern with internal organizations turning over their tasks to the external organizations.

The second place where the case did not support the theory was during the Prepare phase. As a judgement task, it was expected that the use of structure data would be high. Instead, it included unstructured as well. Databases to track training objectives prior to and during exercises, scenario events to be injected to the exercise to help the training audience to meet their training requirements, and other databases and spreadsheets helped planners to execute exercises. Also, intelligence gathered data on airfield capacity to determine the type of aircraft that could land there, size of the tarmac and other airfield related information planners would need to plan missions. All data were structured. Information was also gathered and stored on things like hospitals, what capabilities they had, the number of beds, etc.

- Research Question #3: Are there other factors, such as Process Support Level, Military Command and/or Partners, that provide a more robust explanation of the types of data shared during the activities of the U.S. military in HA/DR events?

The level of support does not seem to be a good indicator, except for the Strategic level. At the Strategic level unstructured information sharing allowed the partners to have an open forum allowing for the free flow of ideas and concepts. This facilitated the development of plans and policies. It also allowed for an unrestricted collaborative environment.

Command level is a good predictor of logistics and communications sharing structured data since the information they dealt with is quantitative. However, intelligence and operations data was found to be a mix of data types and thus is not necessarily a good indicator for the type of data that was shared. Plans were usually unstructured but may contained some quantitative data that was structured. Thus, I conclude that military command level is not better variable for the model then is the phases variable.

Internal versus external partners with whom information was shared, alone is not a good predictor. However, when combined with the phase variable, the adapted model can help predict the type of data shared. For example, during Assess phase almost all data from external organizations was unstructured. Another example was found during the deploy phase where the internal organizations almost always dealt with structured data such as flight manifests and plans. Out of four independent variables that were explored, the Phases variable offers the greatest support for the TTF theory as modified and applied to HA/DR.

The two humanitarian assistance/disaster relief case studies provide excellent examples of the technology platforms used for data during the 2004 Indian Oceans tsunami and the 2010 Haiti earthquake foreign disaster response efforts of the U.S. military. To gain a broader perspective on the U.S. military’s pattern of data sharing during planning exercises and in other relief response efforts, the next chapter examines lessons learned and best practices from the Joint Lessons Learned Information System database. If consistent results are found in a broader context, this will provide triangulation of the finding from these case studies.

CHAPTER SIX

JLLIS DATABASE LESSONS LEARNED

The Joint Lessons Learned Information System (JLLIS) is a system designed to allow stakeholders to capture/document observations and best practices that stakeholders have identified as valuable information concerning lessons learned from crisis and steady state operations, events, and exercises. Information from these lessons learned often serves as the basis for establishing capability requirements where capability gaps exist. This database is available to all service commands, component commands and military organizations. JLLIS is a particularly valuable resource since it also includes entries by interagency organizations that interface with the military as well as those that may not.

The JLLIS database has been around for over 20 years and therefore it provides an historical perspective. Many of the planned military exercises use JLLIS as a means for showing trends and identifying where training is needed to meet readiness requirements. JLLIS is also used to capture observations from real world operations to build meaningful training events and exercises. The contributions about issues go through a process which moves the JLLIS entry from an observation to an issue and then to a lesson learned. These issues can result in policy, procedures, tactics, funding, deployment of resources and other meaningful actions.

I observed a good example of the lessons learned being used to shape an exercise, when I was a member of the Training Staff at AFRICOM in Stuttgart, Germany. A major command exercise was being planned for the AFRICOM headquarters and the early planning cycle was at a point where both major mission sets and training objectives were being discussed and documented. Contributions that came out of Operation Odyssey Dawn, an international military operation in Libya to enforce United Nations Security Council Resolution 1973, were used to shape a major command exercise since the UN Security Council Resolution formed the basis for military intervention in the Libyan Civil War. A no-fly zone was established as part of this action and the resolution also authorized all means necessary, short of foreign occupation, to provide protection of civilians. The lessons learned included documented contributions from various present at this operation. The AFRICOM staff reviewed these contributions and selected the most significant ones to be addressed as part of the exercise and training objectives of an upcoming headquarters exercise.

Another example I observed occurred when I was at Camp Smith, Hawaii, transitioning to my new job as the JLLIS Program Manager for the US Pacific Command. An observation was documented in JLLIS about how medical supplies were slow to getting to their destination during and after flooding in Bangladesh. Bangladesh is prone to flooding and the JLLIS observation suggested that emergency medical supplies be pre-positioned in the region for quicker response and that those supplies be updated in accordance with a pre-planned schedule to ensure their quality. This was escalated through the Joint Lessons Learned process as an issue. It went through various staffs at the command for review and concurrence and funding sources were identified. The Chief of Staff was briefed on the resolution proposed and approved the funding to provide that capability.

JLLIS entries regarding information sharing date back to 1997. Over this period of time from 1997 to 2018 over 1,000 contributions/lessons learned have been captured regarding information sharing. Between the years 1997 and 2004 the number of entries averaged about 5.5 per year.

Starting in April 2004 (and more than six months before the Indian Ocean tsunami, President Bush talked about information sharing in context to National Security and Antiterrorism. President Bush also commented that “We’ve got to share information on a real-time basis, so first responders and police chiefs can move as quickly as possible.” He also commented that “We're charged with the security of the country, first responders are charged with the security of the country, and if we can't share information between vital agencies, we're not going to be able to do our job.” (Bush, 2004). Some of the points he makes apply across other missions, such as humanitarian assistance and disaster relief, where there are interagency as well as coalition partners and where sharing information is vital is in working together toward a common goal. (https://georgewbush-whitehouse.archives.gov/news/releases/2004/04/20040420-2.html).

It was late in that same year that the Indian Ocean Tsunami occurred, which impacted an entire region. After that in 2005, the number of entries jumped by a factor of five from 9 to 48, reflecting an increase in documenting the need for information sharing and the ways and means to share it. This is important because the included details on a wide variety of stakeholders from a wide variety of agencies, DoD and government, that traditionally would not share information except in extreme instances where time is critical as in the coordination of resources, capabilities, and manpower, needed to provide relief as quickly as possible.

Another noticeable spike was several years following the Haiti earthquake, when another disaster that required a multinational and inter-agency response (as well as local, non-governmental, and international organizations) was necessary. This was necessary to conduct relief operations in the most efficient way, to achieve success, and leverage the capabilities these various organizations contributed as part of the relief operations.

There were multiple factors within the JLLIS database coded for analysis during this research. These factors included the period of time the contributions were identified and recorded in JLLIS, the phases of disaster response that were described (this included the preparation phase prior to an event even occurring), the functional organizations that the lesson learned impacted, whether the data/information shared was structured or unstructured, and whether the data/information was shared with internal or external partners. The contributions/lessons learned selected from the JLLIS database were chosen based on whether they identified information sharing as an observation, provided discussion of the observation or described the resolution of the observation as an issue, and the lesson learned.

Phases of HA/DR Operations

The focus of this study is on the data being shared and in particular whether that data is structured or unstructured during different phases of a disaster relief. In this section, I compare the phases to data type, to identify any patterns.

Phase 0, Prepare

This phase is dominated by unstructured data. The Prepare phase reflects a lot of unstructured information sharing allowing for open communications, collaboration and planning among the stakeholders. A higher proportion of unstructured data makes sense in this phase, since it can include planning a multinational exercise or preparing for a port visit or some other type of regional security engagement event with internal partners in real time. The heavy reliance on unstructured data does not fit the expectation for the Prepare phase as described in the Literature Review.

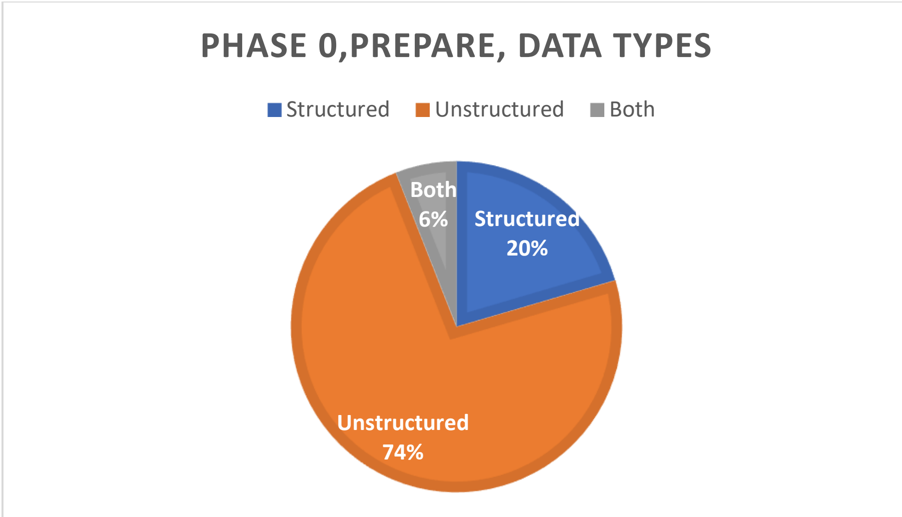

Figure 6.1: Data Type Used in Prepare Phase

Phase I, Assess

During the Assess phase there is more of a balance in the JLLIS lessons learned between structured and unstructured data being identified for information sharing. Information comes in from non-traditional sources and is usually unstructured, while the structured sources data come from more traditional sources. An example is USAID's MITAM, a document which tends to provide structured data more than unstructured data. The finding that there is a slightly heavier reliance on structured data is consistent with the theoretical predictions in the Literature Review.

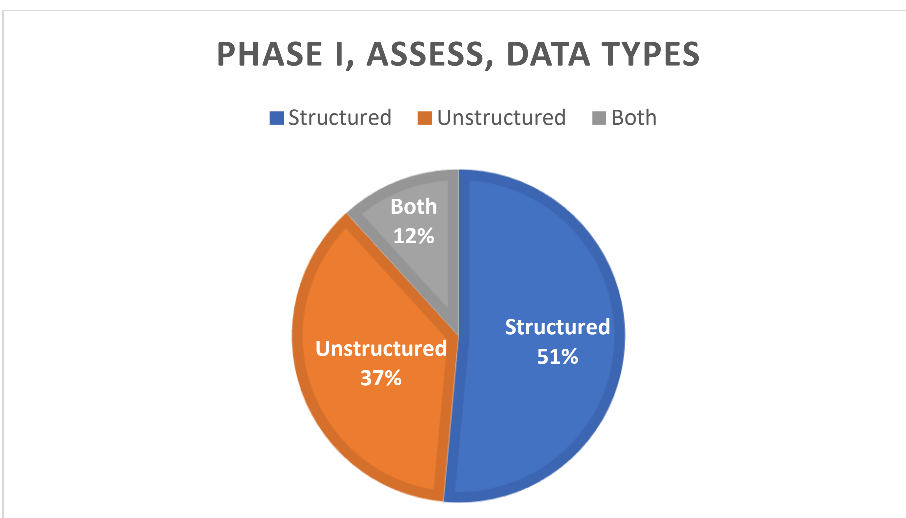

Figure 6.2: Data Type Used in Respond Phase

Phase II, Respond

Structured data dominates during the Deploy phase. The data associated with this phase are more exact and more quantifiable. The data from the Lessons Learned in the JLLIS database tend to be most associated with personnel movements as well as material, supplies, food, water and medical supplies to the right people at the right time. Figure 6.3 shows a slight reliance on structured data for this response phase, which fits the prediction made in Chapter Two.

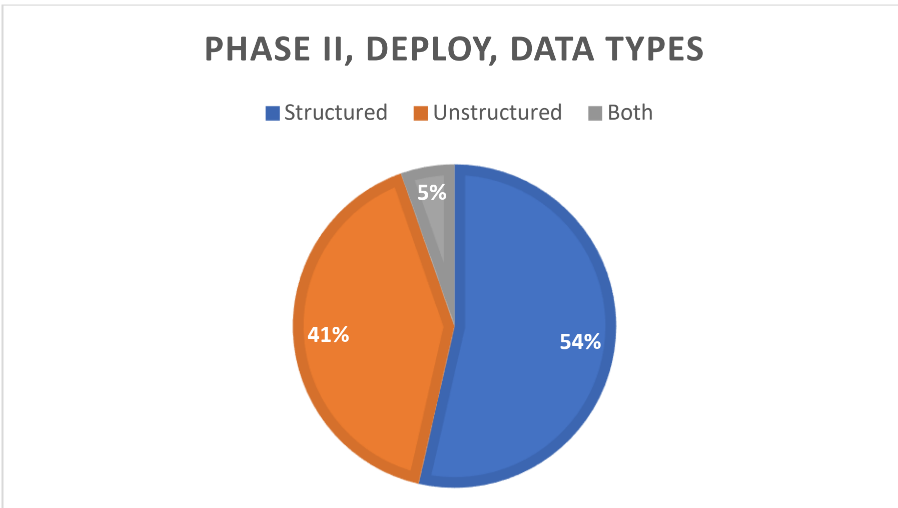

Figure 6.3: Data Type Used in Deploy Phase

Phase III, Execute

The Execute phase results show a dominance of unstructured data that is shared with multiple organizations. During the execute phase, it is predicted that there would be a balance of unstructured and structured since this phase pulls in from all the military command staffs. As shown in Figure 6.4, this expectation was accurate.

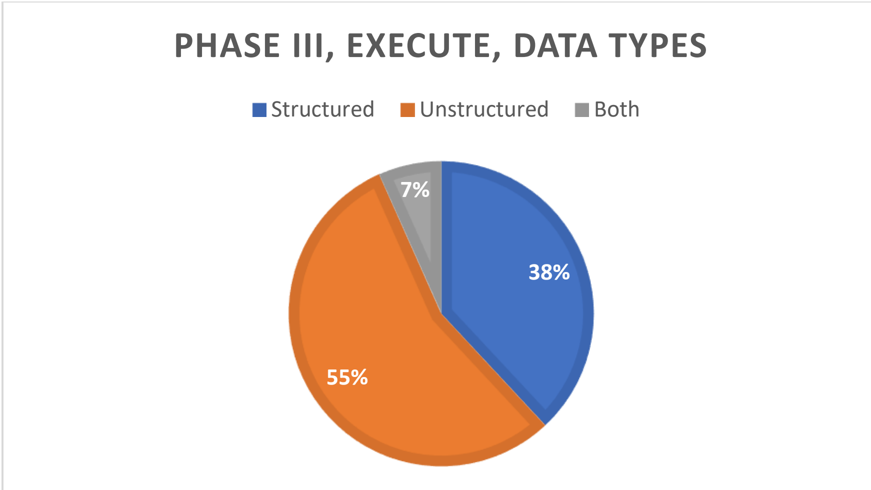

Figure 6.4: Data Type Used in Execute Phase

Phase IV, Transition

Unstructured data seems to be slightly more prominent in this phase. In many cases, the transition phase hands responsibilities back to external partners with whom the U.S. military infrequently shared data. This situation would suggest less commonly defined data elements and therefore less structured data. Therefore, the expectation would be for more unstructured data sharing. Evidence from the JLLIS lessons learns supports this expectation.

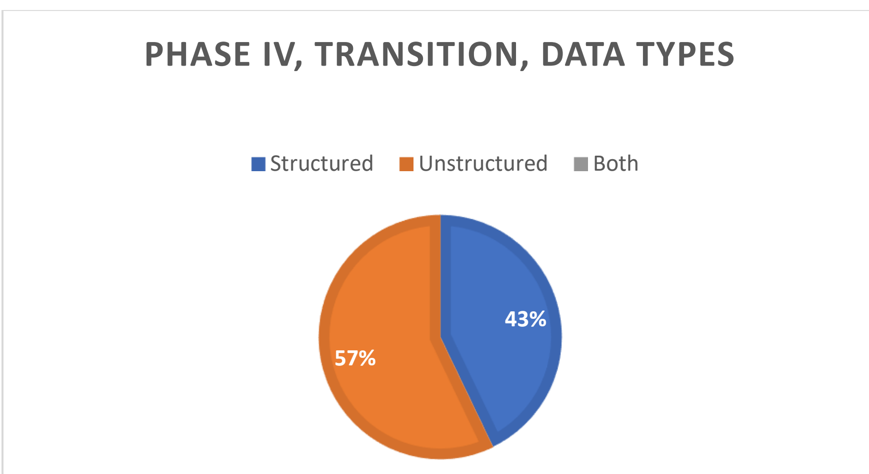

Figure 6.5: Data Type Used in Transition Phase

Phase V, Redeploy

Very much like the Deploy phase and for the same reasons, the Redeploy phase is dominated by structured data. The data associated with this phase, such as personnel movements and well as material and equipment movement returning to home stations, are more exact and more quantifiable. Based on this, it was predicted that there would be greater use of structured data during the Redeploy phase. As shown in Figure 6.6, the details in the JLLIS lessons learned contributions support this expectation.

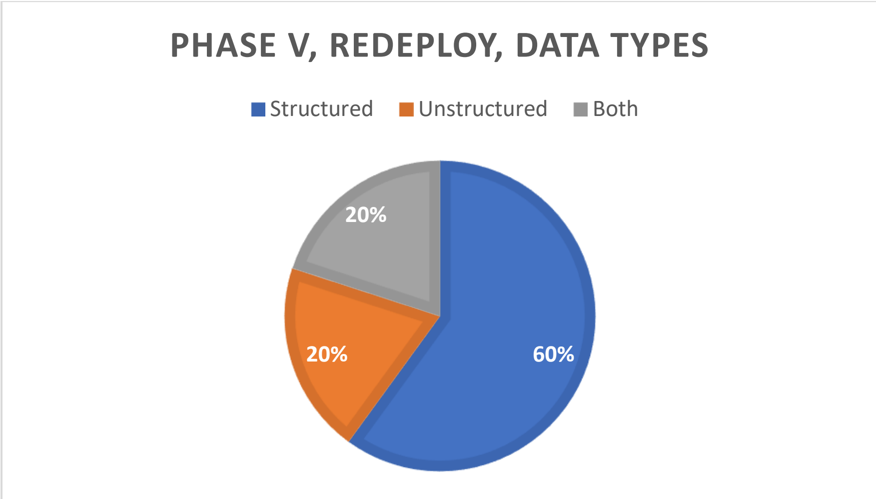

Figure 6.6: Data Type Used in Redeploy Phase

Figure 6.7 compares the patterns for data sharing in the JLLIS cases across the six phases of foreign disaster responses. Phase 0, the Prepare phase, reflects the highest reliance on unstructured information sharing. According to the authors submitting the JLLIS lessons learned, this fosters open communications, collaboration and planning among the stakeholders in contrast to the prediction of structured data from the adapted TTF framework. At the other end of the spectrum (literally and from a theoretical prediction framework) is the Redeployment phase where military units use primarily structured data to return to their home organizations and to normal operations. This finding conforms with predictions.

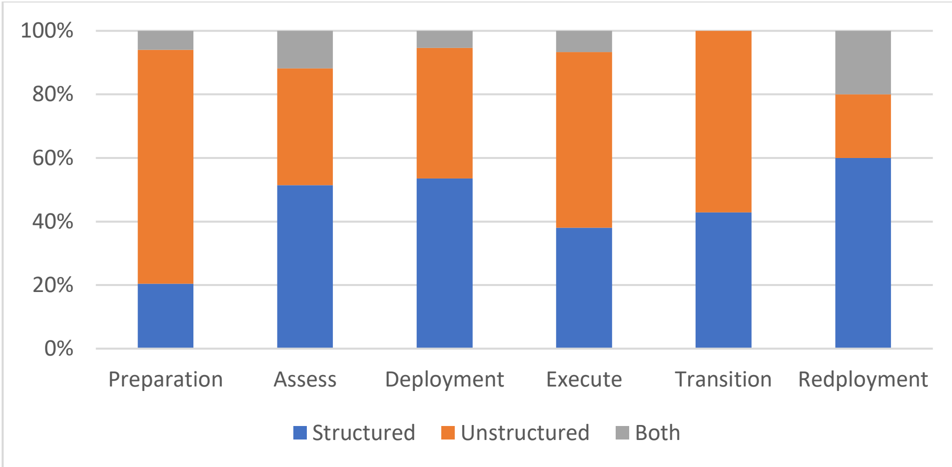

Figure 6.7: Summary of Data Types Across All Phases

As noted in the discussion of each phase, the JLLIS data did not fit the TTF Theory as well as the findings from both HA/DR case studies. Part of the reason for this may have been that the broad perspective about information sharing provided by the JLLIS lessons learned reflects not only contributions from the Indian Ocean tsunami and the Haiti earthquake but also other federal government organization and U.S. military activities that are included in exercises and crisis action events as well as steady state events.

Table 6.1 uses the adapted task-technology fit framework to analyze the relationship between the five task phases and the types of data that were being shared in the JLLIS lessons learned. Reviewing this type, we can see that the practices align with theoretical predictions for many of the cells. However, there are cells in which the predictions could not be confirmed.

Analyzing the JLLIS lessons learned contributions as a group, cells for the simple tasks (which were equivalent to the Assess phase) reported data sharing in a way that were not predicted. Overall, the JLLIS data reported greater use of unstructured data. For the decision tasks in the Transition phase, it would be necessary to combine real time data with the data that was already available via structured sources. Yet the JLLIS cases do not specifically reference utilization of this mix of data types. Finally, the Executive phase, in which fuzzy tasks are featured described more structured data and less unstructured data sharing. These findings, however, may not be accurate since I did not have control over the narrative in the lessons learned. It may be possible that structured and/or unstructured data were shared, but the JLLIS lessons learned authors neglected to include this information. This is a threat to the validity of the findings in this chapter that was out of the control of this analysis. However, the sensitivity of the findings overall are not thought to be significantly challenged.

Table 6.1 Comparison of Data Type by Task/Phase

Phases & (theory-based Task Types)	Date Types and Magnitude Compared to Expected. √ = as theoretically expected, ? = not as theoretically expected		
	Unstructured Data	Structured & Unstructured Data	Structured Data
I Assess (Simple)	? High	√ None	? Medium
II Respond IV Redeploy (Problem)	√ Low √ Low	√ Low √ None	√ High √ High
V Transition (Decision)	√ Low	? None	√ High
0 Prepare (Judgement)	√ High	√ None	?Low
III Execute (Fuzzy)	? Low	√ Medium	? High

Process Support Level

If the military is asked to assist in an HA/DR event, it can participate at the tactical level, operational, or strategic level. More times than not, the JLLIS database cases suggest a combination of all three, with the primary process support level determine by the military's role.

Strategic

Unstructured data stood out as the Strategic level of support data type. This makes sense since strategic level support often times also involves strategic messaging. Unstructured data allows many avenues to get information out to the public for messaging and communications. The use of unstructured data also allows strategic planners and leadership to communication and collaborate in an open unrestricted environment.

Operational

The Operational level showed approximately a 40-50-10 distribution of structured, unstructured, and both data types. What was expected was a higher use of structured data. The analysis still shows above average use of structured data. The operational support level covers a broad spectrum of activities and a mix such is shown here is not unreasonable.

Tactical

The Tactical support level also suggest a roughly 40-50-10 distribution of Structured, unstructured, and both data types. This combination is as predicted since the personnel performing on the ground tasks will benefit from access to pre-established and real time data.

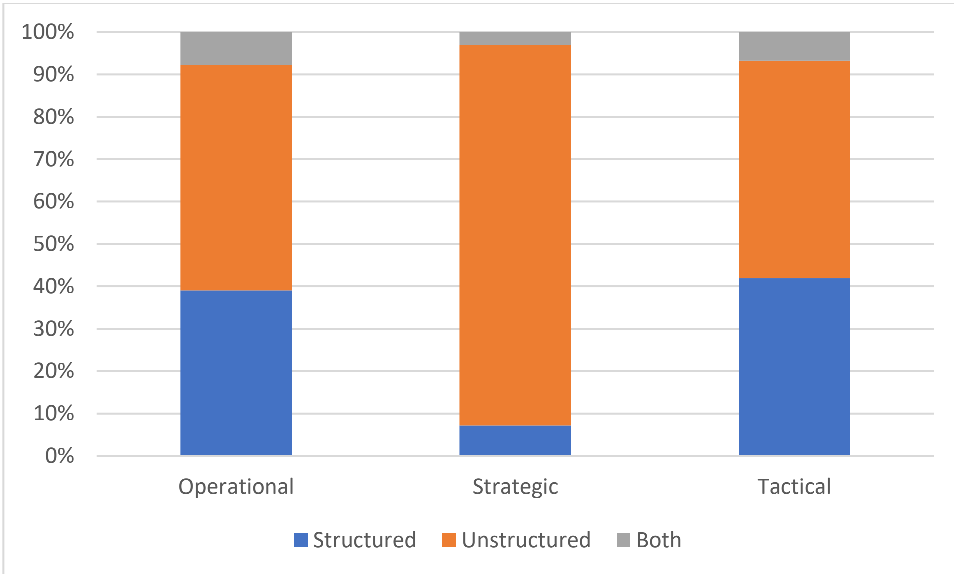

Figure 6.8: Data Type across Process Levels

When reviewing the lessons learned in the JLLIS database, the strategic process support levels used primarily unstructured data as expected. The tactical support level relied a mix of structured and unstructured data technology platforms. This also supports the predictions from Chapter Two. However, the operational process support level is expected to have the highest reliance on structured data based on training exercises that assist in the planning and development of data sharing platforms. In this respect, the JLLIS data analysis shows more reliance on unstructured data than would be expected.

One possible explanation for this is that this data source includes cases from a longer time period and especially those that are more current than the 2010 Haiti earthquake. The introduction and widespread adoption of unstructured data platforms for sharing data by U.S. organizations is consistent with the examples given above about the emphasis placed on this type of data for homeland security purposes. So, the longitudinal nature of the JLLIS data is likely driving the mix of data sharing found for the operational process support level. In addition, as noted above, the material included in the contributions was not required to report on utilization of structured and/or unstructured data by the U.S. military or its partners.

Military Command

Almost all command staffs are build with a functional reponisibility. The staffs name reflect the area of expertise and their functional role. The accountability of the six command levels included in this analysis is based on varying responsibilities which are described next.

Personnel

For the Personnel command, I would have expected more structured data because the type of data is usually well defined. Yet as Figure 6.9 suggests, this was not the case.

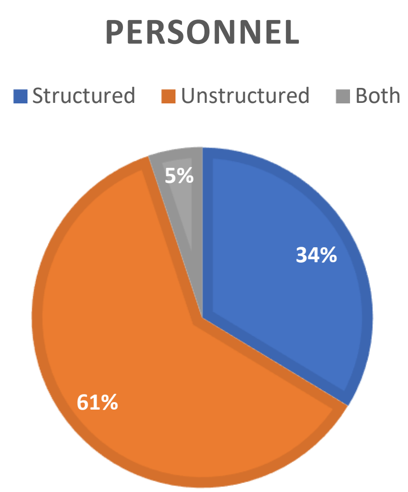

Figure 6.9: Data Types Used by Personnel Staff

Intelligence

Intelligence data comes from many and varied sources in many types of formats many of which are unstructured. This data has to be analyzed and considered in the broader context to appreciate its value. Analyzing the JLLIS lessons learned contributions, the majority of the data is unstructured, which is as predicted for informing activities with real-time data.

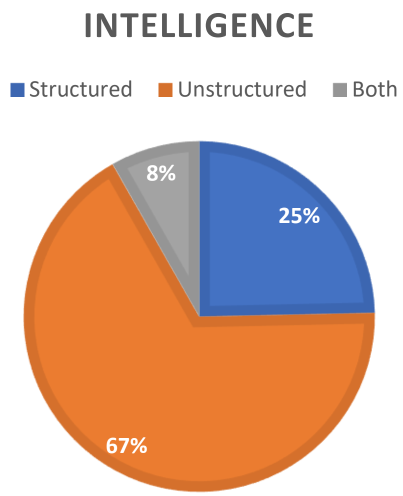

Figure 6.10: Data Types Used by Intelligence Staff

Operations

The data used by Operations comes in the form of both structured and unstructured. Figure 6.11 shows unstructured data at 55%, which is not that much higher than structured data. This makes sense because personnel performing the operations function would benefit from data delivered to them more quickly, which is the primary advantage of unstructured data.

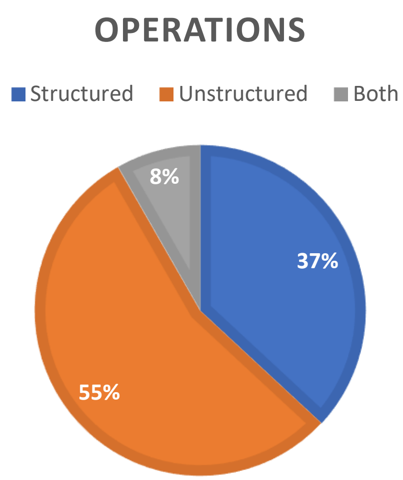

Figure 6.11: Data Types Used by Operations Staff

Logistics

Logistics activities, as suggested throughout this study, benefits from the use of structured data. The finding in the JLLIS data base also supports this prediction (see Figure 6.12). A heavy reliance on structured data makes sense since quantifiable data is often shared to coordinate the workforce that will be deployed and the equipment they will use.

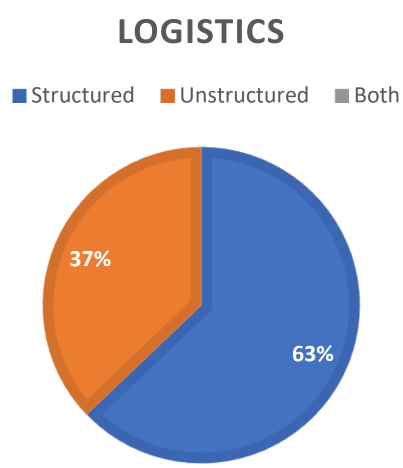

Figure 6.12: Data Types Used by Logistics Staff

Plans

Unlike Logistics, the Plans command is dominated by unstructured data and for good reason. Unstructured data for information sharing, allows for open communications, collaboration and planning among the stakeholders without putting unnecessary restrictions that are common to structured data technology platforms. As shown in Figure 6.13, 78% of all data reported in the JLLIS observation is unstructured when used by the Plans command.

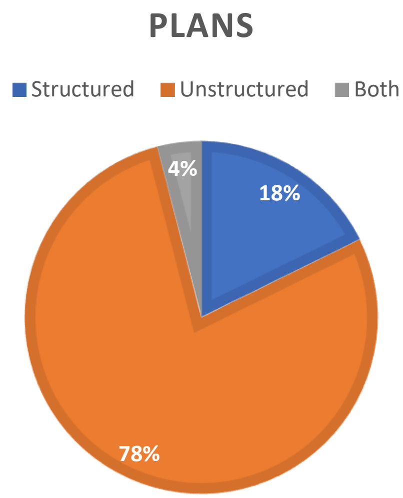

Figure 6.13: Data Types Used by Plans Staff

Communications

Communications data sharing in the JLLIS observations also has a bit of a disconnect. Because of the technical nature of communication activities, one would think that there would be more structured than unstructured data. Yet, the use of unstructured data was slightly more than half. One potential contributing factor for this finding is that the training exercises in Phase 0 were included in the database. As described above, the training exercises had a higher than expected presence of unstructured data.

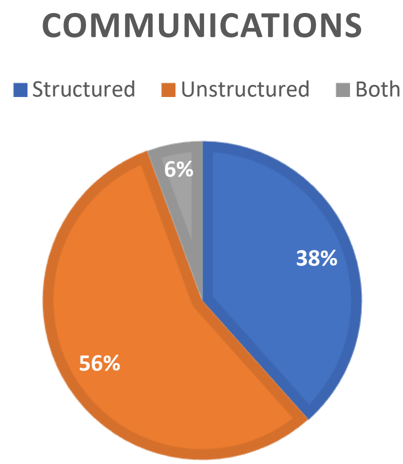

Figure 6.14: Data Types Used by Communication Staff

Reviewing the patterns found in the JLLIS lessons learned contributions, across all six military commands, the analytical conclusion is that all commands had a stronger tendency toward unstructured data with the exception of the Logistics command. This finding makes sense because logistics data usually deals in numeric values, including number of units, sizes and shapes, weights, capacity and other numeric values. The Logistics function was included in at least 20% of the other functional areas so the level of unstructured data reported in Figure 6.15 may be inflated due to double counting based on the coding scheme and analytical protocol.

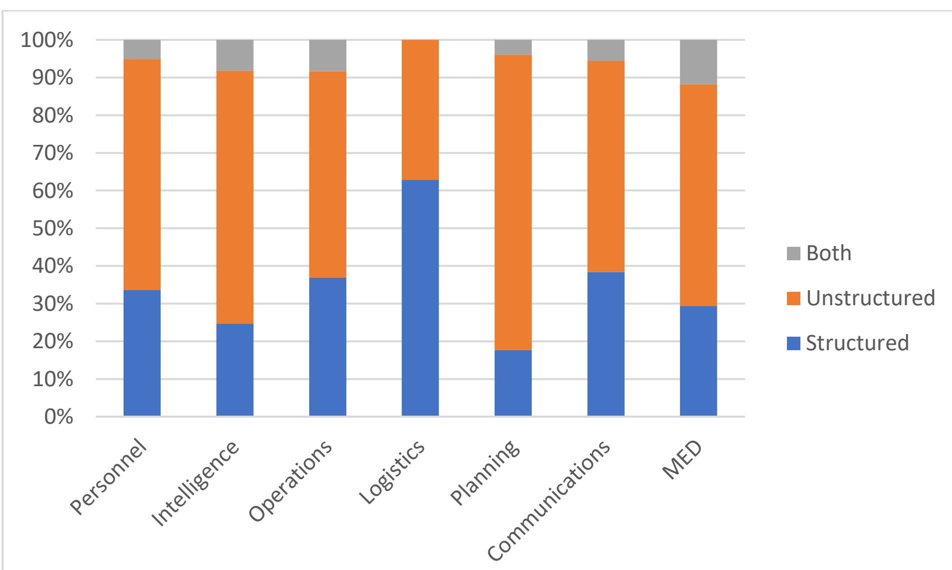

Figure 6.15: Summary of Data Types Across Staffs

Partners

The Partners variable considered are both internal and external partners participating together as part of a disaster relief effort. Partners can come from a variety of organizations, some military, governmental, non-governmental, international, regional/local, and so on.

Internal

Internal partners are federal organizations with whom the U.S. military organizations share information. As can be seen in figur3 6.16 the JLLIS contributions documented the use of unstructured data at a rate of 58% and structured data 36%. This finding is as expected since internal organizations are common partners with the U.S. military. For the majority of internal partners, they have already been vetted and have access to structured data technology platforms. The sharing of unstructured data would also fall within the boundaries of information that was authorized to be shared during the access vetting process.

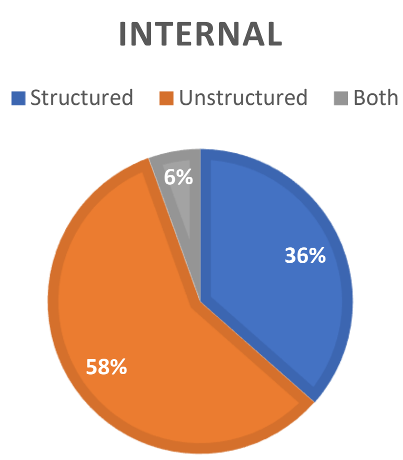

Figure 6.16: Data Types Used with Internal Partners

External

External partners are organizations that typically do not work with the U.S. military and not a part of the larger federal organization structure. Unstructured data was reported at a rate of 64% and structured data 28% (see Figure 6.17). When compared to internal partners, it makes sense that there is more unstructured data because data elements are not always defined or the same between disparate organizations.

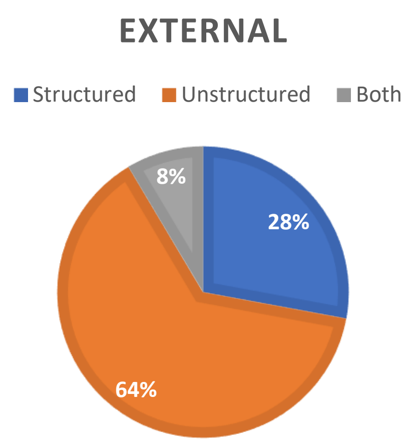

Figure 6.17: Data Types Used with External Partners

Comparing the internal and external partners and the type of data, Figure 6.18 shows that the use of structured data was favored with external partners. However, there was not that much different between external and internal partners and data sharing. This finding is slightly different than what was found in the two case studies and also different from what was predicted in the literature review. Similar to the explanation that was offered above, the different patterns are thought to be reflective of the longitudinal data and presence of data that are more recent than 2010 as well as a lack of consistency in reporting data types and sharing in the JLLIS database.

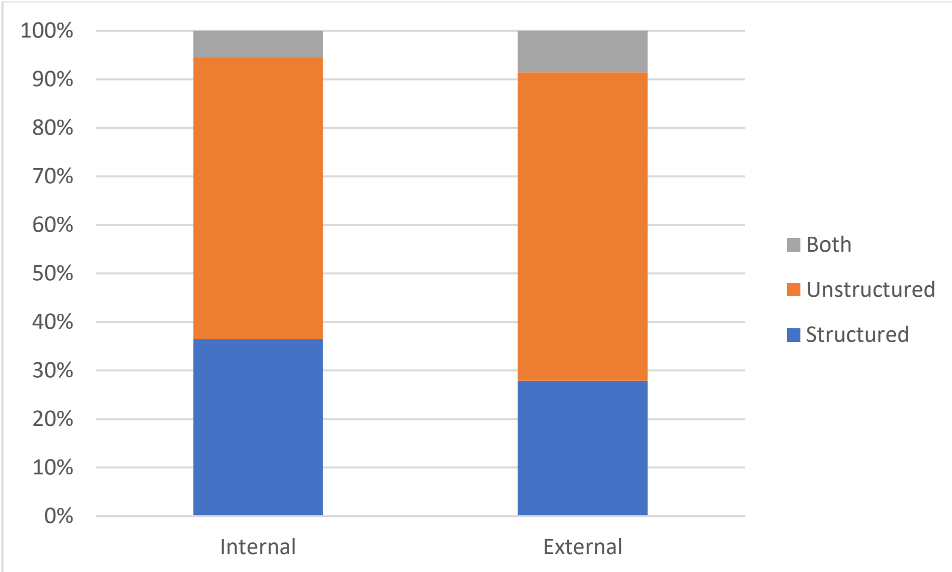

Figure 6.18: Summary of Data Types Across Internal/External Partners

As much as 80% of the world's data is unstructured (www.netowl.com, Aug 17). Almost without exception all the contributions in the JLLIS lessons learned database that were used for this analysis, reflected a higher reliance on unstructured data over structured data. Seldom, however, did the mix between structured and unstructured data achieve the 80% rate reported by netowl. This research provides a more in depth look at the various factors identified to if which factors most impact the use of structured or unstructured data based on the technology platforms supporting them.

Entries for information sharing increased by a factor of five after the 2004 Indian Ocean tsunami. Within this number, the volume of structured data increased to about 30%. Compare this to three years before that, when it was 15% lower. Also, there was a two-fold increase in structured data after Haiti earthquake. There seemed to be a gradual increase in unstructured data after the Haiti earthquake, with the most significant increase coming in 2009.

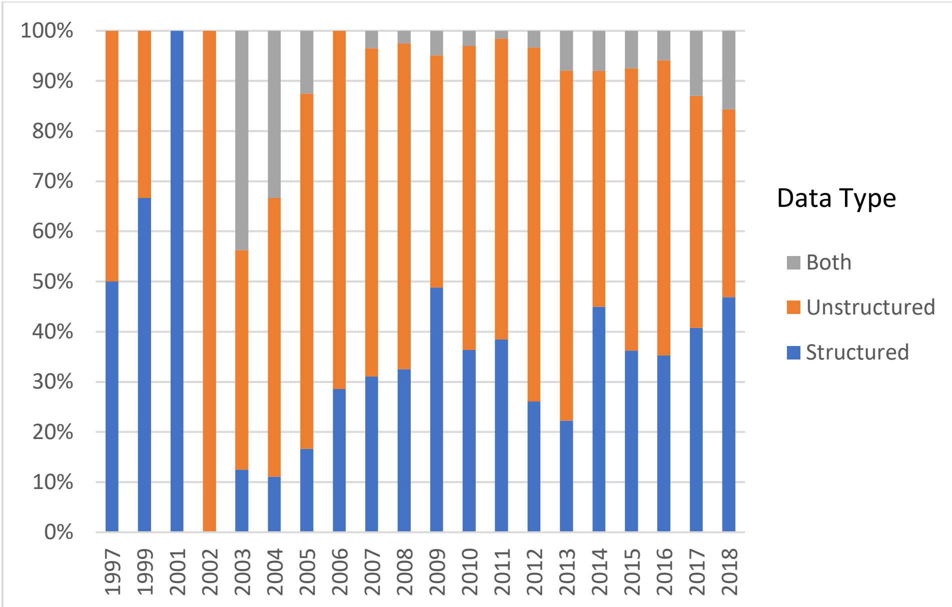

Figure 6.21: Structured Data vs Unstructured Data over Years

The researcher more closely examined the same information for the period of time 2005-2010, to see if there were any identifiable trends during this period of time. Following that, the focus turned to the period of time 2010 to the present, the years following the Haiti Earthquake to once again determine if there are any noticeable trends. As shown in the longitudinal bar graph, there are no clear patterns except for the conclusion that both structured and unstructured data sharing has consistently occurred over time with no real dominance of one type over another. Further, the trajectory of neither data type suggests a shift in the type of data that will primarily be shared in the future. Finally, it is surprising that the combination approach for sharing data peaked in the 2002-2005 time period, likely in part to the emphasis placed on this by President Bush as a means for consolidating and coordinating homeland security efforts. However, the focus on internal organization cooperation has not declined as much as the most recent utilization of combination data would suggest.

Chapter Summary

In this chapter, a primarily quantitative data source was evaluated. The JLLIS database provided a wealth of lessons learned contributions that spanned a much longer time period than did the individual Indian Ocean tsunami and Haiti earthquake HA/DR cases. The findings from this chapter allow for triangulation of the findings from the qualitative case data to the quantitative results from the JLLIS cases. Answer to the three research questions featured in my analysis using only the JLLIS data are provided below.

- Research Question #1: What are the types of data shared by the U.S. military in HA/DR events?

Using the time period from 1997-2018, the steady transition to unstructured data that would be expected based on technology advancements that benefitted not only the U.S. military but people and organizations around the world was not consistent. Clearly, the JLLIS contributions emphasize unstructured data. However, they also suggest a pairing of that data with structured data. Another surprising find was that the combination approach of sharing data across both types of technology platforms has been and continues to be a relatively small proportion and with no clear longitudinal trajectory.

- Research Question #2: What is the relative fit between the Task variable and the types of data shared by the U.S. military in HA/DR events?

Similar to the overall analytical conclusions that were reached in the Indian Ocean tsunami and the Haiti earthquake case, and as predicted by the adapted Task Technology Fit theory, there are patterns suggesting data sharing preferences. However, considering the 15 cells predicted by the theory, there is an increase in the number of cells that do not fulfill the theory's prediction using the JLLIS data. The use of unstructured and structured data for the Assess phase was not as predicted since there was a higher reliance on unstructured data than would be expected and only a medium reliance on structured data. The Execute phase did have a high reliance on structured data but a surprisingly low reliance on unstructured data. Finally, for the Prepare phase, the use of structured data was low. This is perhaps the most surprising finding from the more than 1,000 cases since the preparation phase is when the U.S. military has the highest level of control. One possible explanation for this is that, over time, the training exercises have evolved to include more international partners slightly reducing the ability (and willingness) to share technology platforms hosting structured data.

- Research Question #3: Are there other factors, such as Process Support Level, Military Command and/or Partners, that provide a more robust explanation of the types of data shared during the activities of the U.S. military in HA/DR events?

Similar to the findings in the two case study chapters, the presence of internal and external partners can increase the explanatory power of the disaster response phases variable. With regard to the other independent variables that were included in the analysis for the testing of alternate explanations, the evidence does not suggest any enhancement based on the process support level or military command.

More direct comparisons of the findings from the three substantive case chapters and across time are the topic for the next chapter. After discussion of the comparative findings, I describe the robustness of the adapted task technology fit theory and make modest suggestions for theoretical improvements. Following that, I consider the practical implications of this study and offer recommendations to improve practice as well as future research to overcome some unavoidable threats to validity of the findings of the study.

CHAPTER SEVEN

Discussion and Theoretical and Practical Implications

Although literally half a world apart two natural disasters, the Indian Ocean tsunami in 2004/2005 and the Haiti earthquake in 2010, provide an important source of case study data for analyzing the U.S. military's response to foreign Humanitarian Assistance/Disaster Relief activities. Supplementing the qualitative case data are quantitative data derived from the U.S. governments' Joint Lessons Learned Information System (JLLIS) database. Drawing from more than 1,000 lessons learned, the JLLIS material provides insights into the trajectory of the relationship between task and technology for more than 20 years. Leveraging the mix of data provided by these multiple data sources allows us to answer the primary research question:

What is the best way to share critical information between diverse organizations who partner with the U.S. military in HA/DR efforts?

This chapter makes conclusions about whether information sharing is better served by data that is unstructured, such as that found in social media, or by more traditional structured data, such as that which is found in lists and databases. I aggregate the findings from the three empirical chapters to draw overarching conclusions about how different types of data are shared and how this is influenced by four independent variables (phase, process support level, military command and partners). This empirical analysis constitutes both a deductive and an inductive test of an adaptation of Zigurs & Buckland's (1998) Task and Technology Fit Theory (TTF). This theory was originally designed to explain the fit between task and technology in the setting of a single corporation. I adapted the theory to apply and test on HA/DR events featuring internal and external partners drawn from the entire range of organizational sectors. The partners also include individuals, such as citizens in the disaster are who were not members of any organization but were part of the HA/DR response.

For the deductive test of TTF theory, the key independent variable of interest is the tasks associated with an HA/DR event. The tasks are analyzed during six typical disaster response phases to assess the correlation between the tasks in each phase and type of data shared. For the inductive test of the TTF theory, the three remaining independent variables (process support level, military command, and partners) are tested to see if they provide a more robust explanation of the utilization and sharing of structured, unstructured and/or a mix of these two types of data.

By comparing the findings from each of the three analytical chapters across the deductive and inductive theory tests, the analysis identifies similarities that confirm the theoretical relevance of task and technology fit theory when to a multi-organization HA/DR event. Nuanced differences in the findings across the empirical three chapters are explored now to see if: 1) they are idiosyncratic to the contextual setting of the disaster response efforts, 2) if they challenge the adaptability of the TTF theory to HA/DR versus strict application to an autonomous corporation, 3) if they suggest enhancements to TTF theory to encompass all organization types, or 4) if they introduce challenges to the robustness and generalizability of the extant theory.

To determine theoretical robustness and generalizability, the first section of this chapter is organized by the three research questions introduced in Chapter One to determine if TTF can be adapted to HA/DR events. The second section discusses what this dissertation's empirical findings mean in terms of trends identified and how to better fit task and technology in real world HA/DR settings in which the U.S. military is a first responder. The second section also discusses how these findings are the same as, or different from, the corporate setting of a single firm with no external partners for collaboration on tasks. This section also describes threats to validity that could be overcome in a future research agenda. The final section summarizes the conclusions from this research, suggests implications of this research for HA/DR responses by the U.S. military and makes recommendations to enhance current practices.

Findings for an Adapted TTF Theory

When the U.S. military is involved in a foreign HA/DR event, the organization must share information internally between functional units within the military command structure, between commands, between services, between other U.S. federal organization, between other foreign militaries, between non-governmental and international organizations and with residents of the foreign country. Some of the data that is shared is structured, which enables critical data to be passed between various systems, provided partners in the disaster relief effort have similar technology platforms and security clearance for data access. Some of the data that is shared is unstructured, allowing the data to be more descriptive in real time, yet open to interpretation. Two-way sharing of both types of data are essential for the U.S. military's disaster relief activities. Unstructured data coming in from responders with "boots on the ground", or from satellite images, can help planners and decision makers piece together a common picture of the current operations. Structured data used for logistics, deployment and redeployment of forces are essential for calculating payloads, monitoring and managing resources, and planning activities.

Research Questions #1 and #2 allow us to assess the transferability of the theories related to the importance of task and technology fit. Table 7.1 recaps the analytical findings regarding the types of data used from each of the three substantive chapters to answer Research Question #1: What are the types of data being shared by the U.S. military in HA/DR events? The similarity across the columns confirms the importance of technology platforms for structured and unstructured data. In addition, comparing the top of the table with the bottom of the table, there is evidence that combination approaches were critical in the JLLIS lessons learned contributions.

The left column of Table 7.1 provides the tasks in which the different data types were shared to answer Research Question #2: What is the relative fit between the task variables and the type of data that was shared by the U.S. military in HA/DR events? There is sharing of both structured and unstructured data across all three cases; however, as described below, the magnitude of use differs, suggesting that trajectories for data sharing are changing over time.

Table 7.1 Data Types in the HA/DR Cases

Data Phase	Indian Ocean Tsunami	Haiti Earthquake	JLLIS
Structured Data			
0. Prepare	Exercise Planning tool Country Studies	Exercise Planning tool Country Studies	Exercise planning execution, engagement activities, studies
I. Assess	Assessment Reports	Assessment Reports	Damage reports/causalities
II. Deploy	Orders Writing Administrative docs Personnel docs	Orders Writing Administrative docs Personnel docs	Admin tasks related to deploying responders
III. Execute	MITAM RFA/RFI/IDP Status	MITAM	Information to plan and conduct operations
IV. Transition	Transition Metrics	Transition Metrics	Information to transition activities to relief organizations
V. Redeploy	Cargo manifests PAX Manifest Orders	Cargo manifests	Admin tasks related to re-deploying responders
Unstructured Data			
0. Prepare	Document sharing Translation	Document sharing Translation	Exercise planning execution, engagement activities, studies
I. Assess	Emails Posts Lists	Emails Posts Lists	Damage reports/causalities Admin tasks related to deploying responders
II. Deploy	Email	Email	Information required to plan and conduct operations

III. Execute	Email Collaboration Tools Chat	Email Collaboration Tools Chat RFA/RFI	Information to transition activities to relief organizations
IV. Transition V. Redeploy	Document sharing Email Collaboration Tools Chat Emails Lists Phones	Document sharing Email Collaboration Tools Chat Emails Lists Phones	Admin tasks related to re-deploying responders

As we can see in Table 7.1, there are very similar patterns for the use of technology platforms that support structured data across all three cases. Considering the unstructured data, the biggest difference is found by looking at the Indian Ocean case, where the RFA/RFI status was communicated via structured data platforms. By comparison, in the 2010 response to the Haiti earthquake, the RFA/RFI status reports were done via unstructured data technologies. In addition, even though structured data continued to be shared and used, for the Haiti case the lion's share of unstructured data was in the form of social media use because of the popularity and increased availability of these technology platforms. Another notable finding from Table 7.1 is that the JLLIS lessons learned contributions highlight a higher mix of structured and unstructured data for every data phase. Provided below are specific comparative observations about the fit between tasks and technology for each of the six phases.

Phase 0 – Prepare

The data characteristics of the first phase known as the Prepare phase, depend a lot on what information is being shared. When using the labels from the TTF theory, the activities in the Prepare phase are Judgment tasks. This phase consistently had an emphasis on information sharing, such as information need for planning the exercises, including logistics to support and exercise control over the group that runs/manages the exercises as well as the training audience.

Most all the training tools used in the Joint Exercise Life Cycle are kept in databases for support of the exercise execution. Also, used is interactive applications (IBM Workplace and Intelligent) for sharing/posting documents, and other media for use in planning.

Phase I - Assess

Analysis of the second phase of an operation, Assess, reveals that a lot of data is collected from many different sources and the information must be assimilated and processed within some pre-established structure to make it actionable. These kinds of activities represent a Simple task characteristic. There are some nuanced differences between the two disaster relief case studies during the Assess phase. To a large extent data including satellite imagery was generated by many different organizations and shared via social media applications during the Haiti earthquake. This was different from the Indian Ocean tsunami assessments which were made using photos created by the U.S. Navy P-3 aircraft and compared to other visual and narrative data shared by humanitarian and military organizations on the ground.

Phase II – Deploy

Problem Tasks characterized the Phase II Deploy. Once the assessment was completed, decisions were made for manpower and resource movement to the affected area. Most of the data used in this phase was predominately shared in structured format. The information needed to be processed and provided in a consistent format, so it could be easily used and shared in a timely manner with the U.S. military's partners.

Phase III – Execute

Phase III which is the Execute phase, has the task characteristics of a Fuzzy task. The reason is because it tends to involve Requests for Assistance or Request for Information at both the tactical and operational support levels. The technology platforms best suited to providing this information feature structured data, such as the USAID Mission Tracking Matrix does. The data can be exported and analyzed since they are already in a structured format. During this phase, assessments continued to be made available to the relief organization but tended to taper off at the end of the operation. This information was used to help decision makers evaluate when the Transition phase can start further supporting the expectation of Fuzzy task characteristics.

However, a mix of data was present as well. Media and non-profit organizations made extensive use of Twitter and Facebook to provide their audience on the relief efforts. Even though these activities do not directly impact the U.S. military's operation, the unstructured data used as public relations tools by all partner organizations were at the strategic support level.

Phase IV – Transition

Planning and coordination was done during Transition phase for the smooth, orderly transition of military resources and manpower to home stations as well as the transfer of the military's activities to the humanitarian organizations. The data shared in this phase is structured as would be predicted for Decision tasks. Structured data is paramount since it provides accountability for equipment and manpower. The structured data is also needed to help ensure that the capacity and capability that is being removed from the disaster relief efforts are being replaced during the transition allowing the relief organizations to continue their mission.

Phase V – Redeploy

The activities during the Redeploy phase are very similar to the Transition phase, with a big exception. The tasks are primarily problem solving since personnel and equipment may be returned to their home stations or they may be needed to bolster the mission of the U.S. military in other parts of the world. Information sharing among the internal military was necessary to coordinate the airlift requirements to support the redeployment, supporting the prediction of the type of data that would be shared for a problem task.

To answer Research Question #2, the findings from the TTF Theory table in each of the empirical chapters has been consolidated. The Indian Ocean tsunami and the Haiti earthquake had many of the tasks and in the same format. In the five-year period that separated these two events, the basic tasks and the data format used to share the data as reported in the JLLIS lessons learned contributions were very much the same. Using the data from these three sources, the adapted TTF framework correlated very well with the theoretical TTF framework. The only exception was found in a couple of the results from the JLLIS analysis. There was low correlation between the Fuzzy Task (Execute Phase) and the utilization of the technology platforms for structured data sharing. This may be because JLLIS covered a wider time span and had create diversity in the contributions and the report of data sharing by types than just HA/DR activities and specific foreign disaster response efforts. The other task that did not correlate as well was the Simple Task (Assess Phase). The empirical analysis found that more data comes from both unstructured and structed data sources than what the TTF theory designed for a single corporation would predict. Similar to the Fuzzy Task exception, this may be because of the enlarged timeframe, broader range of information sharing and the multiple external partners in the JLLIS contributions.

The table that consolidates the findings is found in Table 7.2. Two case study results along with the findings pulled from the JLLIS database. The TTF theory-based task types and the adapted TTF or phases are in bold print in each of the five cells of the left most column. Then within each of the cells of the results of the Indian Ocean case study, the Haiti Earthquake and JLLIS are further broken down. The next three columns represent the Communications Support

Dimension as Unstructured Data, the Information Processing Dimension as Structure Data, the Process Structuring Dimension represents both. The values in the table, high, medium, low, have been transferred from the Zigurs and Buckland's table to the adapted TTF table as the expected value. After examining the data, if the expected value was the same it was marked by a check indicating a good fit for that part of the theoretical framework and if not it was marked with a question mark. The model seemed to fit pretty well given all my seven of the 45 possibilities. The one noticeable exception was the unstructured data. For the Indian Ocean case and JLLIS, this might be expected since use of unstructured data in an HA/DR was still developing in its technology and its availability. Use of structured data is still critical to information sharing needs during an HA/DR, but the contributions of unstructured data is growing, but does not play as big a role as expected during the Execute phase.

7.2 Phases/TTF Task Types vs Data Type and Expect Results

Phases & (theory-based Task Types)	Date Types and Magnitude Compared to Expected. √ = as theoretically expected, ? = not as expected		
	Unstructured Data	**Structured & Unstructured**	**Structured**
Simple Task=Assess Phase Ch. 4: Indian Ocean Ch. 5: Haiti Ch. 6: JLLIS	 √ High √ High √ High	 √ Low √ Low √ Low	 √ Low √ Low ? Medium
Problem Task=Respond/Redeploy Ch. 4: Indian Ocean Ch. 5: Haiti Ch. 6: JLLIS	 √ Low √ Low √ Low	 √ Low √ Low √ Low	 √ High √ High √ High
Decision Task=Transition Phase Ch. 4: Indian Ocean Ch. 5: Haiti Ch. 6: JLLIS	 √ Low √ Low √ Low	 √ High ? Low ? Low	 √ High √ High √ High
Judgement Task=Prepare Phase Ch. 4: Indian Ocean Ch. 5: Haiti Ch. 6: JLLIS	 √ High √ High √ High	 √ Low √ Low √ Low	 √ High √ High ? Low
Fuzzy Task=Execute Phase			

Ch. 4: Indian Ocean Ch. 5: Haiti Ch. 6: JLLIS	? Low ?Low ?Low	√ Medium √ Medium √ Medium	√ High √ High √ High

An important finding from this analysis is that unstructured data, as used in social media, is a good fit for Fuzzy Tasks for getting data/information to planners, so they can assess the information and then make informed decisions. In addition, the public relations function is made easier through Facebook and Twitter feeds.

The Indian Ocean Tsunami Relief effort took place in December 2004. Social media was not as big then but web technologies such as Lotus Sametime by IBM, used by the Navy Collaboration at Sea Program was referred to as a “poor man’s video teleconference” that could share information in an unstructured format. It provided video/audio, chat, file sharing and other such collaborative capabilities. Another Web 2.0 technology that used was IBM Workplace. It enabled us to empower responsible staffs with the ability to build the information within their Workplace that would best suit them, and their audience needs.

The Haiti earthquake was five years later, and social media had grown by leaps and bounds. Even the All Partners Access Network was labeled a social networking site. They used and still use a collaborative platform called Telligent which had very similar capabilities as IBM Team Workplace. During the Haiti Relief operation, the All Partners Access Network also used Adobe’s Connect. (The Asia-Pacific Area Network originally introduced this as a product developed by Macromedia, known as Macromedia Breeze).

Further support for this finding is found in two more recent examples of the use of social media not related to these case studies. The first example pertains to the 2011 Japan tsunami and what the U.S. Embassy personnel in Japan did prior to the tsunami during the Preparation phase. The U.S. Embassy reached out to all U.S. citizens in the country and set them up with Twitter accounts. When disaster eventually struck, the U.S. citizens were contacted by Twitter. This is a great use of unstructured data for relief operations since it shares data directly with individuals. A tweet received directly from the U.S. Embassy assured U.S. citizens that the information was legitimate. The task characteristic was simple and can easily be transferred to other settings and partners. The Tsunami Warning Center in Hawaii has a similar system for using phone systems to warn/inform citizens if there is a tsunami approaching the Islands. Further, the U.S. State Department now offers the Smart Traveler Enrollment Program (STEP) to allow U.S. citizens and nationals living abroad to register their plans with the nearest U.S. Embassy or Consulate.

The second example of social media use becoming more vital also falls in the Preparation phase. The All Partners Access Network (APAN) has come up with an ingenious way to use blogs during disaster exercises. Describing events on the blog during the disaster exercise helps the training audience (often including not just the U.S. military, but multinational partners) to meet their training requirements. These blog posts come directly from the Joint Mission Essential Task List which is a structured technology platform but shared with the training audience via an unstructured platform.

Given these two examples, I conclude that unstructured data's biggest relevancy is to Fuzzy Tasks and it remains a good fit as such. However, the caveat is the unstructured data is being leveraged in creative ways to impact the Preparation phase as well.

This research explored three other factors that may also help to determine which technology platforms for data sharing that are most useful. Research question #3: "Are there other factors that provide a more robust explanation of the data sharing activities of the U.S. military in HA/DR events?" is used to analyze these factors.

The process support level of the various disaster response tasks provided by the U.S. military was analyzed to determine if the selection of structured or unstructured data was predicted by whether the information was strategic, operational or tactical in nature. Using these three categories, there were no consistent patterns that could predict the technology platform for data sharing that were more robust than the explanations offered by knowing the phase of the disaster response. This conclusion suggests that there is collinearity between the process support level and the phases of disaster response making analysis of two distinct variables unnecessary.

When analyzing the tasks performed based on the military command with primary responsibility for the task, predictable patterns were not identified either. This may be due, in part, to the fact that the U.S. military was not the lead responding agency, so it had to provide resources based on gaps in resources for the foreign country at which the disaster occurred. Further, as discussed in the analysis of the partner variable, each event had noticeable differences in the internal and external partners. This meant that the relief activities provided by the U.S. military varied dramatically making certain commands more or less active for each case.

Adding consideration of whether the partners were internal partners within the U.S. government structure or external organizations who were also part of the disaster relief efforts improved the explanation of the choice of sharing structured data, unstructured data or a mix of the two. When internal partners were involved with the U.S. military in the disaster relief effort, there was generally a greater reliance on the sharing of structured data. This is reasonable since the technology platforms of the federal government are more likely to be compatible. Additional, security vetting considerations in real time were not necessary since the partners had regularized working relationships and the clearance levels were established in advance.

For data sharing with external partners, it was easier if the partners had collaborated previously, such as in exercises or prior HA/DR efforts. One of the premier systems used to share information in these two events was the Asia-Pacific Area Network, during the Indian Ocean Tsunami relief effort, and later as the All Partners Access Network, during the Haiti Earthquake. This network supported the PACOM commander's regional security objectives. Although it was available to and used by the worldwide community, its focus was regional, which happens to be the largest area of responsibility among commands around the world. The networks supported the Department of Defense as an unclassified information sharing solution to facilitate collaboration and coordination with non-traditional actors outside the military's communications domains. The reasons for this are thought to be similar to the reasons given for data sharing with internal partners.

However, all the of data analytic findings in the empirical chapters suggest that when there is more diversity in the range of external partners, and when individuals and community groups on the ground are engaged in data sharing with the U.S. military, the data sharing tends to make greater use of unstructured data via publicly available platforms that better communicate conditions in real time. A distinct advantage of this approach is that it obviates the need for any kind of security clearance and provides the potential for important updates to be shared and re-posted/shared to a wider range of users. Table 7.2 compares the types of relief organizations participating in relief operations noted in the descriptions in the empirical chapters.

Social media has become a valuable resource that can used during an HA/DR event. In the future, social media may have an increasing role especially in the early stages of a relief operation. It made an impact in several areas including providing a platform for raising relief funds, getting initial assessments from people on the ground, providing a way to keep informed as the relief operation unfolds. The social media of the future may not be the same social media we know today, but some form of it will exist and will be a valuable communication tool for the HA/DR tasks. The internet provides a worldwide availability of communications and these applications that reside on the internet provided the perfect collaborative environment where a wide range of internal and external partners can work together.

Knowing the partners that are going to participate in a relief operation helps to know the type of data they use and the format they use it. Unfortunately, no two HA/DR events are alike and many times the partners are different. However, there is a core of partners that is almost always involved if the U.S. military is involved, such as USAID and U.S. State Department, and the International Red Cross, United Nations Organizations. The more these organizations can practice information sharing in Phase 0, the Prepare Phase, the smoother the operation becomes because the information and the format it is in will be known and processes and procedures to use this information can be developed and exercised ahead of the disaster response.

Comparing partners in Table 7.2, during the Haiti relief effort there were fewer military organizations and international entities. However, there were more external partners and relief organizations, some of them including volunteers who were using social media and web-based mapping capability which they would provide to first responders for their use.

Table 7.3 Partners in Relief Operations

U.S. military Partners	Indian Ocean Tsunami	Haiti Earthquake	JLLIS
Military Units-Domestic	U.S. Pacific Command and Third Marine Expeditionary Force III MEF (Okinawa)	U.S. Southern Command, United States Coast Guard	Countries with a working relationship with U.S. military
Military Units-Other Countries	Australia, Brunei, France, Germany, Japan, South Korea, Malaysia, Mexico, New Zealand, Netherlands, Norway, Pakistan, Russia, Singapore, Spain, Switzerland, United States, United Kingdom	Brazil, China, Spain, France, South Korea, Cuba, Iceland, Canada, United Kingdom, Israel, Italy	
Federal Government Agencies	State Department, OFDA, U.S. Embassy	State Department, OFDA, Department of Homeland Security, FEMA, Department of Health and Human Services, US Embassy	
International Entities	UN OCHA, United Nations Children's Fund (UNICEF), The World Health Organization (WHO), World Food Program, (WFP),	UN OCHA	International Organizations that partner with the U.S. military
In-country Government Agencies	Local Government Agencies	Local Government Agencies	Local Government Agencies
Non-Profits, International and Multi-National Org's	International Federation of the Red Cross and Red Crescent Societies, Red Cross, Medicins Sans Frontiers/ Doctors Without Borders, Save the Children, (109 NGOs would provide assistance)	Oxfam, International Committee of the Red Cross, Food for the Poor, Mercy & Sharing, World Vision International, Télécoms sans frontiers, SOS Children, Humanity First	NGOs from around the world
Local organizations	Local media	Local media	Community organizations

Individuals or groups of individuals	Residents with cell phones	Residents with cell phones	Diverse individuals or groups of individuals

Theoretical Fit and Recommended Enhancements

With all these dimensions taken into consideration, the adapted Task-Technology Fit Framework was ideal for the examination of two historic disaster relief case studies along with the lessons learned in other humanitarian assistance/disaster relief events. This research found that the theory has application for virtual organizations provided it incorporates the presence of data sharing partners. To do this, the theory would need to differentiate between internal and external data sharing partners. When partners are present, the Assess and Execute tasks rely on both structured as well as unstructured data, in large part due to advances in technology platforms that favor one over the other. One could easily argue that corporations have at least as good, or not better, access to emergent technology would benefit from the same advances in data sharing capabilities, especially in the transmission of real time data that is needed by multiple partners/organizations. In addition, as high-visibility security breaches in the corporate world suggest (i.e., Google, Yahoo, eBay, Equifax and FaceBook), security concerns related to vetting who has access to data in the corporate sector parallel those of the U.S. military. Therefore, the adapted TTF model is suggestive of changes that could be made to the original TTF model.

Basing the analysis on just two cases will limit the generalizability of the findings. However, the study begins exploration of a gap in the task-technology fit literature to determine its portability from a single organization and routine tasks to an episodic virtual organization with expected and unexpected actors who play different roles during the phases of the relief efforts. For an exploratory endeavor such as this, sacrificing precision in results that can be obtained when analyzing a high number of cases in order to provide a richer understanding of the cases is a reasonable tradeoff. Small-n comparative case analysis allows for close examination of contextual nuances and identification of future concepts that can be included in future research that will be able to better overcome the threats to the external validity of the research results. Even though I argue that the theory can be enhanced to be portable to multi-organization collaborations, there are some threats to validity of the research design that could not be completely mitigated that cause me to be more circumspect in my claims.

For example, the selection of cases is purposeful since the author can provide first-person validation of the secondary source data. However, both the data as well as the author's recollection suffer from the threat associated with recalling but not re-interpreting historical events. As more and more time elapses, and as the world experiences more and more HA/DR events and relief efforts, there is potential for the events to be interpreted differently today than they would have been at the moment they occurred. The analysis relied heavily on triangulation of the findings to mitigate this threat to internal validity. Adaptation of the theory needs to be tested with corporate sector organizations to determine the generalizability of these cases that primarily reflect U.S. military actions. Future academic research needs to verify proposed enhancements to theory and to overcome threats to validity that could not be controlled.

To test and extend the findings of this study, researchers interview various internal and external partners that have played key roles in a recent multinational HA/DR effort that included the military component. The individual(s) from these organizations should be in a role where information sharing was critical to the completion of their tasking and which contributed to the coordination and success of the relief effort. The following are some examples:

- Military staff members, foreign and domestic. These should be individuals from the task force, whether joint or combined, and/or from staffs that interfaced with the task force. These members can also address the specific task they performed.
- USAID and the State Department. They can confirm how well government and interagency partners exchanged information and what format and confirm the fit with the adapted TTF theory. A special look and the use of the MITAMs and the exchange of information with the Humanitarian Operations Center would help confirm this. They may also be able to address other interagency partners. If not, more interviews can be conducted as appropriate.
- United Nations. This representative would be from the individuals imbedded in the task force and who they a key role as a UN representative or liaison.
- International Red Cross and other IOs and NGO. I specifically mentioned the International Red Cross not only because they are world-wide and are often involved in international responses, but they were interviewed after the Indian Ocean Tsunami and that interview was captured in JLLIS. Other members of organizations should be picked based on the extent of their involvement.
- APAN staff. I would also interview a member of the APAN staff. They provide an unclassified environment outside the U.S. military domain in which traditional and non-traditional partners can exchange information, plan and coordinate. I would probably select a knowledge manager as they would have the best pulse on what is being exchange and how it is being exchanged.

Research Summary and Practical Implications

Even with all the training exercises, planning and preparation, that are done to prepare for natural and man-made disasters, no two disasters are the same. This conclusion is a mantra perpetuated among relief organizations who respond to natural and man-made disasters every day. But, prepare they must; despite the differences in the HA/DR event that requires a response. There are many things that are common between disasters and many lessons learned. The preparation is shaped by these lessons learned. Close examination of these prior events is extremely useful in helping organizations to prepare for a wide range of disasters ranging from small localized events such as the Nepal earthquake or Philippine mudslides, to once in a lifetime, geographically-dispersed events, such as the earthquake off the coast of Sumatra that resulted in a tsunami that impacted a region that covered three continents.

The findings from the three substantive empirical chapters reveal that the cases of the two HA/DR events, as well as the JLLIS lessons learned contributions, have a lot in common. For example, there are a lot of the same participants even though the HA/DR events or exercises occurred in different parts of the world. Some other generalizations that can be made about the participants in HA/DR preparation and on the ground response activities are that:

- There is worldwide support from public, private and non-governmental organizations from around the world,
- Relief support typically comes from the U.S. military along with other foreign militaries
- HA/DR events test the responders' ability to work together and share information, and
- Technology used to share information can be based on platforms that support the sharing of structured and/or unstructured data. However, the trend over 20+ years of case data is toward structured data sharing with internal partners and unstructured data with external partners. As the

data analyzed in this study demonstrate, both internal and external partners are engaged with the U.S. military to different extents during certain phases of the HA/DR event; because of this, there is a parallel reliance on a mix of structured and unstructured data.

In a humanitarian assistance/disaster relief event, the key to providing relief and comfort to the victims is that it is done with speed and efficiency, which in many times exceeds the resources and capabilities of the impacted nation. The urgency to act is constant whether the disaster is small or massive across multiple continents. However, if it is a large-scale multinational response effort, the effort becomes more complex. These kinds of events have many and varied actors, each of whom offer unique resources and capabilities. The matching of data types for information sharing that support coordination between a quickly assembled group of internal and external partners is the biggest practical implication from this research.

A 1992 study by Wong concluded that organizations perform better when they work together in a cohesive environment. Sharing information internally and externally among the organizations is expected to improve group cohesion and as a result improve the performance of the organization. Based on this logic/premise, how information is shared becomes important because of the diversity of the actors and the established networks in which they work. As long as the information exchange and collaboration stay at the unclassified level, then the commercial internet and other technology platforms are beneficial for sharing unstructured data and can be used as the common denominator for that purpose.

The practical applications of this researcher will benefit organizations asked to participate in these types of relief efforts. The results provide insight into contextual variables that the various functional organizations can determine the type of data to use for the task they must perform. For example, the National Guard has an initiative involving information sharing among the states when they have to work together called Shared Situational Awareness. This information is not only shared between state-level National Guard units it is also shared between interagency partners, such as the Federal Emergency Management Agency and Department of Homeland Security. These are all traditional or internal partners. The National Guard is moving a lot of their applications to the cloud to support relief missions. The Joint Information Exchange Environment (JIEE) is used to exchange information in order to meet domestic operations. The operations and logistics directorates are requesting that, as a part of the modernization of JIEE, applications, they also develop data systems that have more structure, so they can better monitor and manage their requests for assistance and better for logistics tracking. This fits very well with the adapted TTF model that I have developed in this research.

APAN has already moved all their applications to the cloud to include an ArcGIS server to provide detailed mapping products for the generation of a common operational picture and other geo-spatial products. This provides an excellent model for the National Guard to follow. APAN customers are more diverse then those of the National Guard and therefore tend to have more unstructured information, although it handles both very well. It too seems to fit well with the adapted TTF model

Both structured and unstructured data play a significant role in an HA/DR and both are needed. For example, an unstructured report from the area of operation may indicate a reduced capability at a hospital especially in a situation where the natural disaster left a wing of that hospital unusable. If there is a database or spreadsheet of the hospitals capabilities it can be modified with inputs provided by the unstructured data.

The blending of these types of data will become more common place as developers and relief organizations work together and learn how more how these different data types can supplement and enhance their value. APAN is already using blogs to inject events into exercises taken from a master scenario event list. This learning curve can be enhanced by continually engaging with traditional and non-traditional partners and developing new and better ways on how diverse organizations are going to work together.

When APAN was first stood up in early 2000, the organization consisted of a technical staff (developers, integrators, systems engineers and administrators, etc.), analysts (regional subject matter experts, country former desk officers, former foreign affairs officers), and liaisons from other partner organizations including the Center of Excellence and the Pacific Disaster Center. The APAN staff today operates as primarily a technical staff. However, the engagement with these other organizations continues, especially during exercise planning and execution as well as disaster related conferences. Re-visiting the organization liaison from partner organizations would further enhance the ability to share information in the most effective ways and by leveraging the technologies and processes being developed and improved. This adaptation to the TTF model would also be value added also to the combatant commands around the global to address their unique requirements.

Another practical implication from this study is that APAN is not the only system used during the U.S. military operations relative to HA/DR events. However, in practice a majority of the federal government's focus is placed on this system because of its use by the military combined with a very broad base of use by internal partners. In the future, elements of the APAN system could be adapted and used by more external partners who are predictably involved with the U.S. military in HA/DR events.

Determining the role of the information provider is critical to deciding when and how to share data. Practitioners should determine whether the information provided is necessary for any or all phases of the disaster relief operation. Finally, it must be determined what applications are best used to share the information. Technologies that handle unstructured data are often social media and/or Web 2.0 technologies. While traditional databases, spreadsheets and other delimited information better handles structured data, each has distinct advantages, and both are necessary, for virtual partnerships formed in response to unplanned activities that must be provided by a virtual organization. This adaption of Zigurs and Buckland's (1998) Task and Technology Fit framework improve guidance for the choice of technology platforms to leverage the availability of structured or unstructured data and improve task performance.

Technology will continue to change. The use of drones will become more prevalent, not only to provide assessments but also to deliver critical items such as medical supplies. Drones, like social media, are becoming more and more available to the public at large which increases their availability and creates a larger community of capable pilots. The technology built into drones are becoming more sophisticated in their capabilities. There availability and affordability with a huge return on investments, makes these a good fit for providing rapid response and critical information capture.

If one were to look forward 25 years from now, the end of technology advancements and the blending of structured and unstructured data and technology platforms are not likely. It is more reasonable to predict, the coming together or diverse organizations into a virtual organization to work toward a common goal for providing relief and assistance after a disaster. While the means will continue to change; technological reliance will remain. The challenge will be in the alignment of task and technology processes and procedures to best handle the activities of collaborative response efforts associated with as Humanitarian Assistance and Disaster Relief.

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