

Disaster Relief Logistics

An Academic Framework Evaluation of the
2016 Great Smoky Mountain Wildfires

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Acknowledgements & Dedication

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- Finally, and, honestly, most importantly, to the people of Gatlinburg, Tennessee: For years, you have welcomed my family and I with kindness and hospitality. You have been the core of many of my childhood memories. You have responded after these fires with resolve and grace. You are truly Mountain Tough and are an incredible inspiration, including for this work.

It is my hope that, by writing this, future disaster can be better prepared for now and better acted upon then. Through our work, may we create a world where all are cherished, regardless of the situation they face, for His glory.

About the Author

Clay Daniel is a senior in the Haslam College of Business, where he studies Supply Chain Management and Business Analytics. His family took him to the mountains of Gatlinburg dozens of times as a kid, and it will forever hold a special place in his heart. He stayed in a now-burned unit of Tree Tops Resort, off Sherman Clabo Road, two nights before the fires struck. He can be reached at cdanie24@vols.utk.edu.

About the Faculty Advisor

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Introduction

There is no doubt that Monday, November 28th, 2016 will go down in history in east Tennessee. Starting in the afternoon, the Chimney Tops II fire – which, until that point, had been contained to sparsely-populated sections of the Great Smoky Mountains National Park – exploded in size and impact. Because of a months-long drought coupled with relatively low humidity, the underlying forest floor provided plenty of fuel to sustain the quickly-growing fire. Gusty winds, preceding a cold front, carried sparks to different portions of the Park.

It quickly attacked nearby Gatlinburg, a town of approximately 4,200 residents surrounded completely by the national park (United States Census Bureau, 2017). Residents and visitors alike evacuated the town. Throughout the evening of Monday, November 28th and into the early morning of Tuesday, November 29th, firefighters from Sevier County and surrounding regions fought the blaze, with the immediate goal of protecting existing structures instead of completely extinguishing the fire. This fire caused the deaths of 14 lives and the loss of approximately 2,500 structures (Division of Fire and Aviation, 2017).

In the immediate aftermath of this historic fire, multiple organizations began serving those who had been displaced. Requests for in-kind and monetary support quickly spread through both traditional and social media, and the public dramatically responded. Thousands of items and dollars flooded Sevier County. The central distribution center for relief items covered thousands of square feet and was staffed by hundreds of volunteers. I – and my logistics-focused brain – was humbled by the scale of the effort, the speed at which it had been set up, and the love that drove all of it.

This thesis is a direct result of that. Using the knowledge that I have learned at the University of Tennessee, Knoxville as an undergraduate Supply Chain Management major, I will be examining the effectiveness of this response. From academic sources, news articles written during and after the fires, and a framework originally developed to measure disaster response in a humanitarian logistics context, this present study will measure the response, commending the work that saved lives and recommending improvements for future situations.

Research Objectives

The primary objective of this study is to conduct an evaluation of the humanitarian logistics response during the 2016 Great Smoky Mountain Wildfires. Specifically, this research will utilize a case study method with the application of an academic framework to evaluate processes over three different phases of the natural disaster (Preparation, Immediate Response, and Reconstruction) as well as an overall evaluation of the response.

The secondary objective of this study is to fill a research gap in the academic research area of Humanitarian Logistics. According to a recent literature review in the topic area, further research is needed in other areas of humanitarian logistics, including development and reconstruction operations, relationship management in the humanitarian supply chain, and strategic considerations in the humanitarian supply chain. Another research gap for humanitarian logistics is to work with empirical data, whether for modeling, through surveys, case studies, or other types of qualitative research (Kovács & Spens, Trends and developments in humanitarian logistics – a gap analysis, 2011).

Problem Description and Relevance

The 2016 Great Smoky Mountains Wildfires were a complex of multiple wildfires which began in late November 2016. While the fires originally started in the Great Smoky Mountains National Park, the nearby towns of Pigeon Forge and Gatlinburg had the highest human impact. The fires were responsible for 14 lives, injured 134, and are one of the largest natural disasters in the history of Tennessee (Wikipedia, 2017). Even though wildfires are natural events, the presence of people and man-made structures in and adjacent to the burned area frequently requires continued emergency risk management actions. High severity wildfires pose a continuing flood, debris flow and mudflow risk to people living within and downstream from a burned watershed as well as a potential loss of desirable watershed values.

The relevance of the problem is justified by its magnitude. By December 12, the fires had burned more than 10,000 acres (15 square miles) inside the national park and 6,000 acres in other parts of the area. At least 14,000 area residents and tourists were forced to evacuate, while over 2,000 buildings were damaged and/or destroyed. The Great Smoky Mountains wildfires were the deadliest wildfires in the eastern U.S. since the Great Fires of 1947, which killed 16 people in Maine. In addition, the fires were also the most deadly and destructive of the 2016 Southeastern United States wildfires.

Study Description

This present study first examines the current literature on the topic of disaster relief logistics. It then describes the framework to be applied. This framework was first developed and applied to the crises that occur after the annual rains in Rio de Janeiro, Brazil. It is based on an adaptation of the *21st Century Logistics* conceptual model (originally developed for business logistics purposes) to a disaster relief situation. Following this, a timeline of the events leading up to, during, and following the fires is provided. Finally, the framework is applied to the fires, the analysis is conducted, and recommendations are provided to better prepare for the next disaster.

Methodology

Unit of Analysis and Data Collection

This paper is strictly concerned with the wildfires in the Gatlinburg, Tennessee area in November 2016. While other natural disasters may be referenced, they are only done so for comparison purposes only.

Information on the wildfires was gathered from a variety of electronic sources. Local media outlets, notably the Knoxville News-Sentinel and WBIR-TV, were used extensively to gather succinct information. For on-the-ground reports from the night of Monday, November 28th, the social network Twitter was utilized; users were able to share information and images directly with the public. The Tennessee Emergency Management Agency (TEMA) regularly released press releases during the fire and in its aftermath. Finally, the East Tennessee chapter of the American Red Cross shared information about its available shelters and relief locations.

Academic information was gathered from a variety of sources. Different academics approach the concept of “disaster relief logistics” from multiple perspectives; these are synthesized for an overall view. A framework developed by Silva with the academic advising of Dr. Rodrigues, originally designed for application on the seasonal rains in Rio de Janeiro, is applied to measure the effectiveness of the response to the wildfires.

Qualitative vs. Quantitative Research

There has been widespread debate in recent years regarding the relative benefits of quantitative and qualitative strategies for research. The positions taken by individual researchers vary considerably, from those who see the two strategies as entirely separate and based on alternative views of the world to those who view them as complementary.

Quantitative research consists of those studies in which the data concerned can be analyzed in terms of numbers. Research can also be qualitative, that is, it can describe events, persons and so forth scientifically without the use of numerical data. Quantitative research is based more directly on its original plans and its results are more readily analyzed and interpreted. On the other hand, qualitative research is more open and responsive to its subject. Our position is that both types of research are valid and useful. They are not mutually exclusive and, therefore, it is possible for a single investigation to use both methods (Best & Khan, 1989).

Quantitative research is concerned with the collection and analysis of data in numeric form. It tends to emphasize relatively large-scale and representative sets of data, and is often, falsely in our view, presented or perceived as being about the gathering of “facts”. Qualitative research, on the other hand, is concerned with collecting and analyzing information in as many forms, chiefly non-numeric, as possible. It tends to focus on exploring, in as much detail as possible, smaller numbers of instances or examples which are seen as being interesting or illuminating, and aims to achieve “depth” rather than “breadth” (Blaxter, Hughes, & Tight, 1996).

The key characteristics of quantitative analysis are as follows: Control, Operational Definition, Replication, and Hypothesis Testing (Burns, 2000).

- **Control:** Valid controls enable the scientist to identify the causes of observations. Experiments are conducted in an attempt to answer certain questions. They represent attempts to identify why something happens, what causes some event, or under what conditions an event does occur. Control is necessary in order to provide unambiguous answers to such questions.
- **Operational Definition:** This means that terms must be defined by the steps or operations used to measure them. Such a procedure is necessary to eliminate any confusion in meaning and communication. Stating an operational definition forces one to identify the empirical referents, or terms. In this manner, ambiguity is minimized.
- **Replication:** To be replicable, the data obtained in an experiment must be reliable; that is, the same result must be found if the study is repeated. If observations are not repeatable, our descriptions and explanations are thought to be unreliable.
- **Hypothesis Testing:** The systematic creation of a hypothesis and subjection to an empirical test, is the core of quantitative testing.

The **strengths** of the quantitative approach are: **precision** (through quantitative and reliable measurement), **control** (through sampling and design), **ability to produce causality statements** (through the use of controlled experiments), **ability to conduct sophisticated analyses** (through statistical techniques), and **replication** (Burns, 2000).

However, there are also **limitations** to the quantitative approach. Because of the complexity of human experience it is **difficult to rule out or control all the variables** impacting the subject of the study. Quantification can become an end in itself. It also **fails to take account of people's unique ability to**

interpret their experiences, construct their own meanings and act on these. It leads to the assumption that the discovered “facts” are true, applying to all people in all situations at all times. Finally, **it is not totally objective** because the researcher is subjectively involved in the very choice of a problem as worthy of investigation and in the interpretation of the results (Burns, 2000).

Qualitative research, on the other hand, involves an in-depth understanding of human behavior and the reasons that govern it. Simply put, it investigates the why and how of decision making, as compared to the “what”, “where”, or “when” of quantitative research. Hence, samples are required to be smaller and more focused instead of larger and random. Qualitative research is multi method in focus, involving an interpretive, naturalistic approach to its subject matter. This means that qualitative researchers study things in their natural setting, attempting to make sense of, or interpret, phenomena in terms of the meanings people bring to them. Qualitative research involves the use, collection, and study of a variety of empirical materials – case study, personal experience, introspective review, life story, interview, and observational, historical, interactional and visual texts – that describe routine and problematic moments and meanings in individuals’ lives. Accordingly, qualitative researchers deploy a wide range of interconnected methods, hoping always to get a more well-rounded “grasp” of the subject matter (Denzin & Lincoln, 2000).

The key characteristics of the qualitative approach are (Burns, 2000):

- Events can be understood adequately only if they are seen in context. Therefore, a qualitative researcher immerses her/himself in the setting.
- The contexts of inquiry are not contrived; they are natural. Nothing is predefined or taken for granted.
- Qualitative research is an interactive process in which the persons studied teach the researcher about the issue.
- Qualitative researchers attend to and seek to understand the experience as a single whole instead of as separate variables. The aim of qualitative research is to understand experience as unified.

The strengths of the qualitative approach are (Burns, 2000):

- Because of close researcher involvement, the researcher gains an insider's view of the field. This allows the researcher to find issues that are often missed by the scientific, more positivistic enquiries.
- Qualitative descriptions can play the important role of suggesting possible relationships, causes, effects and dynamic processes.
- Because statistics are not used, but rather qualitative research uses a more descriptive, narrative style, a dependable (in the traditional sense) dataset is not required. This research can be of particular benefit to practitioners who research areas lacking in data; by examining other forms of knowledge, they are able to gain new insight that otherwise might be unavailable.

However, there are also limitations involved with the qualitative approach (Burns, 2000):

- The problem of adequate validity or reliability is a major criticism. Because of the subjective nature of qualitative data and its origin in single contexts, it is difficult to apply conventional standards of reliability and validity.

- Contexts, situations, events, conditions and interactions cannot be replicated to any extent nor can generalizations be made to a wider context than the one studied with any confidence.
- The time required for data collection, analysis and interpretation is lengthy.
- The viewpoints of both researcher and participants must be identified and elucidated to combat potential sources of bias in the analysis.

A summary comparison between the two approaches is presented on **Error! Reference source not found.** (Johnson & Christensen, 2008; Lichtman, 2006).

Criteria	Qualitative Research	Quantitative Research
Purpose	To understand and interpret social interactions.	To test hypotheses, look at cause and effect, and make predictions
Group Studied	Smaller and not randomly selected.	Larger and randomly selected.
Variables	Study of the whole, not variables	Specific variables studied
Type of Data Collected	Words, images, or objects.	Numbers and statistics.
Form of Data Collected	Qualitative data such as open- ended responses, interviews, participant observations, field notes, and reflections.	Quantitative data based on precise measurements using structured and validated data-collection instruments.
Type of Data Analysis	Identify patterns, features, themes	Identify statistical relationships.
Objectivity and Subjectivity	Subjectivity is expected.	Objectivity is critical.
Role of Researcher	Researcher and their biases may be known to participants in the study, and participant characteristics may be known to the researcher.	Researcher and their biases are not known to participants in the study, and participant characteristics are deliberately hidden from the researcher (double blind studies).
Results	Particular or specialized findings that is less generalizable.	Generalizable findings that can be applied to other populations.
Scientific Method	Exploratory or bottom-up: the researcher generates a new hypothesis and theory from the data collected.	Confirmatory or top-down: the researcher tests the hypothesis and theory with the data.
View of Human Behavior	Dynamic, situational, social, and personal.	Regular and predictable.
Most Common Research Objectives	Explore, discover, and construct.	Describe, explain, and predict.
Focus	Wide-angle lens; examines the breadth and depth of phenomena.	Narrow-angle lens; tests a specific hypothesis.
Nature of Observation	Study behavior in a natural environment.	Study behavior under controlled conditions; isolate causal effects.
Nature of Reality	Multiple realities; subjective.	Single reality; objective.
Final Report	Narrative report with contextual description and direct quotations from research participants.	Statistical report with correlations, comparisons of means, and statistical significance of findings.

Table 1: Qualitative vs Quantitative Research

This present study utilizes a qualitative approach to evaluate processes and performance of the humanitarian logistics system. This is justified by the need of development and application of frameworks specifically designed for the humanitarian logistics context.

Qualitative Methods

There are many varieties of qualitative methods. A popular and helpful categorization separates qualitative methods into five groups: ethnography, narrative, phenomenological, grounded theory, and case study (Creswell & Poth, 2017).

Ethnographic research is likely the most familiar and applicable type of qualitative method. In ethnography, the researcher immerses him- or herself in the target participants' environment to understand the goals, cultures, challenges, motivations, and themes the target faces. Its roots are in cultural anthropology where researchers immerse themselves within a culture, often for years. Rather than relying on interviews or surveys, the researcher experiences the environment first-hand, including sometimes as a "participant observer."

The **narrative approach** weaves together a sequence of events, usually from just one or two individuals, in order to form a cohesive story. By conducting in-depth interviews, reading documents, and looking for themes, researchers can determine how an individual story illustrates the larger life influences that created it. Often interviews are conducted over weeks, months, or even years. Themes discovered can be presented in a story-format that is time-neutral; by using this form, conflicting stories and tensions can be highlighted as opportunities for discovery and innovation.

To describe an event, activity, or phenomenon, the aptly named **phenomenological study** is an appropriate qualitative method. In a phenomenological study, researchers use a combination of methods, such as conducting interviews, reading documents, watching videos, or visiting places and events, to understand the meaning participants place on whatever's being examined. Researchers rely on the participants' own perspectives to provide insight into their motivations.

Whereas a phenomenological study looks to describe the overall essence of an activity or event, **grounded theory** seeks to provide an explanation or theory behind the events. Researchers primarily use interviews and existing documents to build a theory based on the data. By applying open and axial coding techniques, themes can be identified and theories built. Sample sizes are often also larger with these studies to better establish a theory. Grounded theory can help inform design decisions by better understanding how a community of users currently use a product or perform tasks.

The **case study method** was made famous by the Harvard Business School. Even mainly quantitative researchers can relate to the value of the case study in how it fully explains an organization, entity, company, or event. A case study involves a deep understanding of the multiple types of data sources and the variation that exists in the particular situation being studied. A case study is helpful in that it presents a complete picture of an event. Case studies can be explanatory, exploratory, or descriptive in nature.

Our choice for this evaluation is to utilize a Case Study method to explore the process and performance in a humanitarian logistics context.

Case Study Method

A case study is an empirical inquiry that investigates a contemporary phenomenon (the case) in depth and within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident (Yin, 2014). The case study method is appropriate when the research question starts with: “How” or “Why”. It is particularly interesting when the studied phenomenon is not clearly or sufficiently theorized, and when it is complex (incorporating several actors, assignments, procedures, goals, etc.). The main types of case study can be identified on the following basis: research design and research purpose.

In terms of research design, case studies can be categorized in the following manner (Yin, 2014):

- **Embedded (multiple units) analysis:** It focuses on different sub-units of a specific phenomenon/entity. It is useful to put into perspective the holistic illusion, to confront rival interpretations, and to strengthen internal validity
- **Holistic (single-unit) analysis:** It is based on the systemic approach of a phenomenon/entity. It is useful when no sub-unit can be identified and when the theory underlying the case is itself of a holistic nature.
- **Single case design:** This design is appropriate when the case is critical to test a specific theory with a clear set of propositions; when it represents an extreme or unusual case; when it is representative of a situation at large; and when it is longitudinal.
- **Multiple case design:** This design is particularly relevant for testing the conclusions (replication), avoiding extraneous variation, providing a larger picture of a complex phenomenon, and comparing different studies (between industries, countries, etc.).

Case studies can also be categorized in terms of research purpose:

- **Exploratory case study:** Usually limited to a single or limited (up to 10) number of cases, the purpose of an exploratory case study is to better understand an emerging phenomenon and/or to propose new theoretical insights to generate new ideas and hypotheses. The interest is particularly strong when existing theories are incomplete or unable to provide a satisfactory representation of the studied phenomenon.
- **Explanatory (or causal) case study:** The goal is to explain a situation, mostly in the form of a causal relationship (too complex for the survey or experimental strategies).
- **Descriptive case study:** The goal is to portray precisely a specific phenomenon. The approach is used when the generality of the phenomenon is of secondary importance.
- **Confirmatory case study:** The purpose is to evaluate the robustness or the weakness of a clearly defined theory (or theoretical conjecture). A conflicting case might be used to falsify a theory by giving examples of events contradicting some theoretical statements.

Due to the fact that natural disasters represent an extreme or unusual case (although cyclical in time) and that existing theories and frameworks related to humanitarian logistics are incomplete, our choice for this present study is to develop a **single case design** with an **exploratory** purpose.

Organization of Paper

This paper has four main sections.

The first section presents an introduction of humanitarian logistics research. In this section, the importance of humanitarian logistics is described in detail. The main tenets of disaster relief logistics are also presented and compared to traditional business logistics. Finally, the three primary phases (Preparation, Immediate Response, and Reconstruction) are described.

The second section presents the literature review. In this section, academic research into the area of disaster relief logistics is summarized. Importantly, the academic framework to be applied in this paper is also described in detail.

The third section presents an overview of the events before, during, and after the Gatlinburg wildfires of November 2016. This section is developed in a timeline format, where the events are presented (roughly) in chronological order. The timeline begins on Wednesday, November 23rd, when the initial Chimney Tops II first was reported, and goes through Saturday, December 3rd. Important events beyond this date are summarized at the end.

It is important to note that in this section, any times reported are in a 24-hour format for clarity:

Conventional Time	24-Hour Format
12:00am	00:00
10:00am	10:00
1:00pm	13:00
11:59pm	23:59

Table 2: Comparison between Traditional and 24-Hour Time

The fourth section presents the application of the previously-discussed academic framework to the specific case of the wildfires in Gatlinburg. This analysis will use standards to determine the effectiveness of the disaster response and will make recommendations for improvement before future disasters.

Overview: The Scope, Importance, and Challenges of Humanitarian Logistics

Within the humanitarian realm, logistics is the processes and systems involved in mobilizing people, resources, skills, and knowledge to help vulnerable people affected by disaster. By 'disaster' we mean 'a disruption that physically affects a system as a whole and threatens its priorities and goals.' A disaster can be natural or man-made. 'Natural disasters' comprise both 'slow onset' disasters such as famine and drought and 'sudden onset' such as tsunamis or earthquakes. Some are cyclical in nature such as hurricanes. Collectively they account for only 3% of disaster relief operations (Van Wassenhove, 2006).

Humanitarian Logistics is defined as the process of planning, implementing, and controlling the efficient, cost-effective flow and storage of goods and materials, as well as related information, from the point of origin to the point of consumption for the purpose of alleviating the suffering of vulnerable people. The function encompasses a range of activities, including preparedness, planning, procurement, transport, warehousing, tracking and tracing, and customs clearance (Thomas & Kopczak, 2005).

Humanitarian Logistics is central to disaster relief for several reasons. First, it is crucial to the effectiveness and speed of response for combating major humanitarian situations by providing necessary items such as health, food, shelter, water, and sanitation. Second, with procurement and transportation included under the function, it can be one of the most expensive parts of a relief effort. Third, since the logistics department handles the tracking of goods through the supply chain, it is often the repository of data that can be analyzed to provide post-event learning. Within logistics data is reflected all aspects of execution, from the effectiveness of suppliers and transportation providers, to the cost and timeliness of response, to the appropriateness of donated goods and the management of information. Thus, it is critical to the performance of both current and future operations and programs (Thomas & Kopczak, 2005).

The common elements present in any supply chain of getting the right goods, at the right time, to the right place and distributed to the right people are still applicable in the humanitarian context. Setting up an efficient supply chain is always a complex operation but in the aftermath of a disaster, humanitarian organizations have to deal with multiple interventions on a global scale and, often, concurrently. At the start, it is speed at any cost and the first 72 hours are crucial. At this stage goods may be flown in from abroad as quickly as possible despite being an expensive option. Later on (the first 90 to 100 days), it becomes a mixture between being effective in helping people and doing this at a reasonable cost (Van Wassenhove, 2006).

The relief-focused supply chain is the ultimate sense-and-respond supply chain. Once a disaster occurs, an aid agency sends in a team of experts to complete an initial assessment of the extent of the damage and the number of people affected. The assessment forms the basis for an appeal that lists specific items and quantities needed to provide immediate relief to the affected populations. Emergency stocks of standard relief items are sent in from the nearest relief warehouses. Calls are made to traditional government donors and the public and commitments for cash and/or in-kind donations secured. Suppliers and logistics providers are lined up, and the mobilization of goods from across the globe begins. When supplies arrive, local transportation, warehousing and distribution must be organized (Thomas & Kopczak, 2005).

Unlike logisticians in the private sector, humanitarians are always faced with the unknown. They do not know when, where, what, how much, where from and how many times. In short, the basics for setting up an efficient supply chain. In addition to the risks of mismatch in supply and demand, disruption is an increasing risk in global supply chains even for the private sector. With longer paths and shorter clock speeds, there are more opportunities for disruption and a smaller margin for error if a disruption takes place. Therefore, one could argue that humanitarian supply chains show the extremes of a trend towards more uncertainty and risk prevalent in today's global business supply chains (Van Wassenhove, 2006).

This is a tremendous feat to accomplish, given the remote places in which disasters tend to occur, the uniqueness of the requirements for each disaster in terms of both expertise and goods, and the fact that the disaster site is often in a state of chaos. Physical infrastructure such as roads, bridges, and airports are often destroyed. National and local government, through which humanitarian organizations must often coordinate their activities, may be severely impacted, or even uprooted in the case of a conflict situation. Transport capacity may be extremely limited, or non-existent (Thomas & Kopczak, 2005).

Balcik and Beamon summarize crucial characteristics of humanitarian logistics (as different from traditional business logistics) to consist of the (Balcik & Beamon, 2008):

- unpredictability of demand, in terms of timing, location, type, and size;
- suddenness of the occurrence of demand in large amounts but with short lead times for a wide variety of supplies;
- high stakes associated with the timeliness of deliveries; and
- lack of resources in terms of supply, people, technology, transportation capacity, and money.

Humanitarian logistics encompasses very different operations at different times, and as a response to various catastrophes. Thus, two main streams of humanitarian logistics can be distinguished: continuous aid work and disaster relief. Disaster management is often described as a process with several stages. Thus, different operations can be distinguished in the times before a disaster strikes (the Preparation phase), instantly after a disaster (the Immediate Response phase) and in the aftermath of a natural disaster (the Reconstruction phase). Not surprisingly, different resources and skills are needed for the three distinct phases of disaster relief (Kovács & Spens, Humanitarian logistics in disaster relief operations, 2007).

Preparation

While natural disasters are difficult to prevent, some regions are more prone to them than others and can thus prepare for particular risks. Evacuation plans can be developed and evacuation can be trained well in advance for such disasters. Also, measures can be taken to limit the effects of disasters. As an example, providers of energy in hurricane-prone areas can put their connections underground, thus minimizing the risk of power shortages and even the number of electrocuted victims. Logistical support is needed in prevention and evacuation-related measures before a disaster strikes (which might be foreseen, e.g. when volcanoes are predicted to erupt or hurricanes are approaching a region); in instant medical and food relief procedures once a disaster strikes, and during reconstruction phases.

Apart from measures to prevent disasters, strategic plans can also be developed for the case when they do occur. The coordination of many different aid agencies, suppliers, and local and regional actors, all

with their own ways of operating and own structures can be very challenging (Kovács & Spens, Humanitarian logistics in disaster relief operations, 2007).

Immediate Response

Once a disaster strikes, the emergency plans of regional actors come to action. However prepared these actors are, they will need to operate in an environment with a destabilized infrastructure. Less developed regions are also more prone to a larger scale destruction of their infrastructure once a disaster strikes. The nature of most disasters demands an immediate response, hence supply chains need to be designed and deployed at once even though the knowledge of the situation is very limited. There is an abundance of aid agencies focusing on relief after natural disasters. Therefore, it is often unknown which resources are available, and even the involvement and contribution of suppliers is unpredictable. This creates many redundancies and duplicated efforts and materials. While military relief operations are usually coordinated from one particular coordination center, the involvement of many different aid agencies in relief operations renders many distribution center-based planning techniques obsolete.

Given all the challenges to coordinate a multi-facility and multi-supplier network, a major emphasis is placed on real-time communication in disaster relief operations. In the immediate response phase, remote aid agencies assume the needs of disaster victims based on very limited information. In fact, the main problem areas of the immediate response phase lie in coordinating supply, the unpredictability of demand, and the last mile problem of transporting necessary items to disaster victims (Kovács & Spens, Humanitarian logistics in disaster relief operations, 2007).

Reconstruction

After the immediate responses, regional actors can begin to aid victims in the location of their family and friends. The reconstruction phase is important as disasters can have long-term effects on a region. In addition, disasters can also have long-term effects on the management of companies. Therefore, in general it can be argued that regional actors should also focus on the reconstruction phase for which continuity planning is needed. Their disaster prevention plans need to be revised to include things that have been learned from the current disaster (Kovács & Spens, Humanitarian logistics in disaster relief operations, 2007).

In the humanitarian context, the cyclical nature of disaster preparation and response has been clearly spelled out by many commentators – for example the description by Safran as shown in Figure 1 (Safran, 2005).

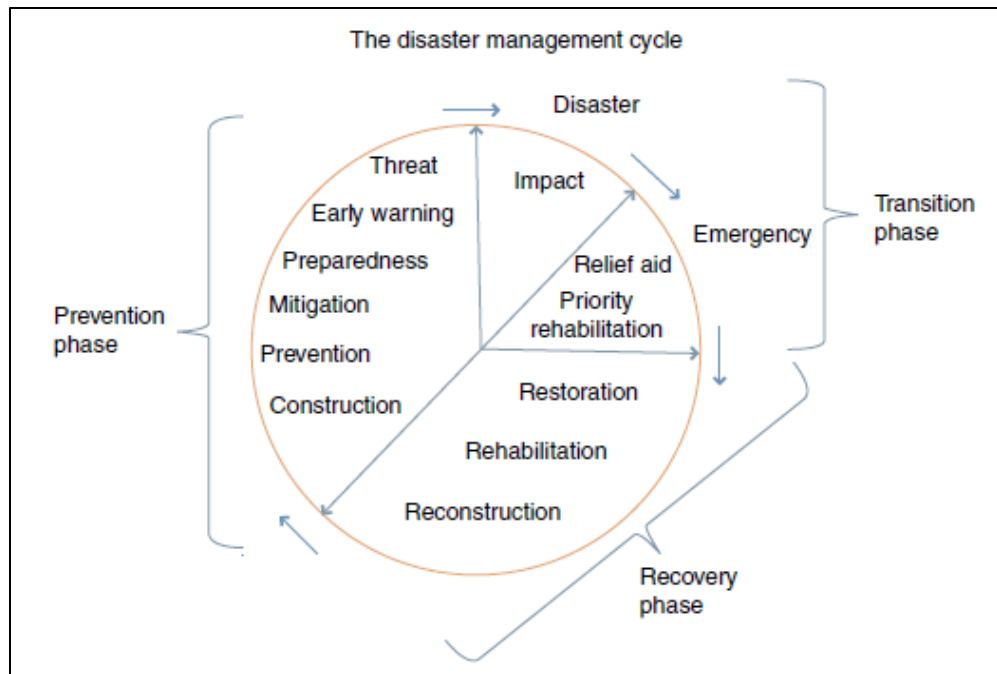


Figure 1: The Disaster Management Cycle (Source: Safran, 2005)

Literature Review

Several literature reviews in humanitarian logistics have been published in different outlets, and for different audiences (Kovács & Spens, Humanitarian logistics and supply chain management: the start of a new journal, 2011). Most of them look at their own background discipline mostly, e.g. Altay and Green (2006) at operations research (and partly operations management) (Altay & Green III, 2006), Kovacs and Spens (2007) mostly at logistics management, and the Emerald reading list in humanitarian logistics only at Emerald journals (Kovács & Spens, Humanitarian logistics in disaster relief operations, 2007). Natarajarathinam et al. (2009) as well as Peter Tatham's bibliography do well in combining the two (Natarajarathinam, Capar, & Narayanan, 2009).

There is though, an agreement that **the operational environment of humanitarian logistics differs from conventional business logistics** (Whybark, Melnyk, Day, & Davis, 2010). Main differentiators are its **unpredictability of demand** (in terms of timing, location, type, and size), **surge of demand with a requirement of large quantities but short lead times**, the high stakes of **adequate and timely delivery**, combined with an **overall lack of resources** (in terms of materials, people, technology, funding, and transportation capacity).

Prior literature has focused strongly on rapid-onset natural disasters, even though these account for about 3 percent of disaster relief operations globally. **Research should therefore also consider more slow-onset disasters, on the verge of development, as well as man-made disasters and complex emergencies, pandemics, and epidemics.** Much prior research has also focused on aspects of inter-agency coordination, performance measurement, information and communication technology for humanitarian logistics, and concepts of agility and responsiveness (Kovács & Spens, Trends and developments in humanitarian logistics – a gap analysis, 2011). **Further research has been called for that would apply also other concepts in humanitarian logistics – even lean management for, e.g., development and reconstruction operations, relationship management in the humanitarian supply chain, the role of humanitarian organizations as service and technology providers, product and service development for humanitarian purposes, and most importantly, strategic considerations in the humanitarian supply chain.**

Past research will also be extended to incorporate new dimensions. For example, inter-agency coordination and purchasing consortia could be combined with supply chain collaboration research. Further logistics concepts, e.g. standardization and modularization, purchasing consortia, vendor-managed inventory, supply chain design, will find their application in humanitarian logistics (Kovács & Spens, Trends and developments in humanitarian logistics – a gap analysis, 2011).

Kovács and Spens (2011) outlined the following areas to be of current interest to humanitarian logistics and supply chain research.

Future Research Areas	Potential Topics within Each
Product/service development for humanitarian purposes	- Product, package, service, and technology development - Product and process standardization and modularization – improving the interoperability of humanitarian operations - The role of humanitarian organizations as service providers
Relationship management in the humanitarian supply chain	- Managing dormant supplier relationships - Relationship portfolios with suppliers, logistics services, and donors
The combination of inter-agency collaboration with supply chain collaboration	- Purchasing consortia in humanitarian supply chains - Sharing resources and capacities, e.g. in transportation, warehousing
Financial flows in humanitarian supply chains	- Managing and soliciting in-kind donations - Matching needs and donations - Microfinance and cash components in aid
The sustainability of aid	- Bridging the gap between disaster relief and long-term development and managing the transitions between these - Supply chain design for preparedness, and with an exit strategy - Community-based supply chain design - Greening humanitarian supply chains - Local, regional vs global sourcing and capacity building
Responding to new challenges	- Urbanization - Climate change adaptation - Security

Table 3: Research Gaps in Humanitarian Logistics and Supply Chain Management (Kovács and Spens, 2011)

In summary, a main concern for humanitarian logistics research is to work with empirical data, whether for modeling, through surveys, case studies, or (other) qualitative research. Another important development will be from the specific to the general, as to say, toward longitudinal studies, cross-case analyses, concept-driven surveys, to the development of generic frameworks and theories.

Academic Framework

As shown above, there are three core strategic goals of the supply chain operating within a **traditional business environment: reduction of operating costs, reduction of investment in capital, and improvement in service level.**

The goal of cost reduction is aimed in minimizing costs associated primarily with the activities of transport, handling and storage. The capital reduction focuses on minimizing investments in assets which are used in logistics activities, maximizing the return on assets. The strategic objective of improving the service level is to maximize the value provided to the customer, associated with the potential revenue maximization and the consequent business sustainability in the long run.

In short, the strategic objective of a business supply chain can, and often is, measured purely on either financial returns to the company or value provided to the customer.

Within a crisis, however, the objectives are particularly different. Gone is any focus on financial measurements: the most urgent priority is on maximizing the service provided to those whose needs must be accommodated. **The primary goal focuses on efficient operations.** Specifically, this translates into the need for the quick handling and delivery of food, water, and vaccinations; the providing of adequate shelter; the availability of medical treatment; and the creation of temporary structures and organizations that aim to return to normalcy.

Another difference with respect to traditional supply chains is that disaster relief logistics are usually done in environments with extreme resource constraints. Whether this is capital (normally measured by monetary or in-kind donations) or infrastructure (both physical and electronic), the difficulties faced – and the variability on a disaster-by-disaster basis – are unlike traditional logistics activities.

Because of the differences in both the method and desired outcomes between traditional and disaster relief logistics, it is clear that the process used to measure the performance of an organization or response must be different too. To this end, a previously-developed framework will be applied to the wildfires of Gatlinburg to measure various outcomes.

The theoretical framework that will be utilized in this study was developed as a joint effort involving academics, practitioners, and military personnel involved with humanitarian operations in Rio de Janeiro, Brazil (Silva, 2011; Garcia, 2013; Rodrigues & Garcia, Logística em Situação de Crise: Sistemas de Mensuração de Desempenho, 2012; Rodrigues A. M., 2011; Rodrigues A. M., 2011). **The framework adapts the traditional business logistics referential into the humanitarian context.** The objective of the academic framework is to assist the relief organizations and response in crisis situations to achieve better performance during future events. For this, the theoretical framework proposed highlights the necessary skills at each stage and performance measures associated.

In terms of conceptual validity, beyond of the academic effort of extensive literature review, this reference framework was developed by Silva with the critical help of professional military area (through contacts with officers of the Navy War College in Brazil - EGN Escola de Guerra Naval), business areas (through lectures at specialized conferences - Annual Forum ILOS Instituto de Logística e Supply Chain) and professionals directly involved in anticipating and responding to crisis situations (through contacts with administrative bodies present in the Operations Center of Rio de Janeiro – CoR Centro de Operações do Rio).

Two additional motivating factors to develop this type of research, beyond the clear objective of improving response systems in crisis, are the recent increase in the number of natural disasters and the fact that commercial supply chains are also affected when such disasters are present. In addition to natural disasters, crisis created by humans (wars, acts of terrorism, etc.) have similar effects on people and disrupt commercial supply chains. As shown previously, supply chains which operate in emergency situations have an urgent priority on maximizing the service level in an environment where the pressures for a need accommodation in time are present. **These pressures require strategies that better anticipate risk in the supply chain and, once an event occurs, responds quickly to create a temporary supply chain that is agile, adaptable, and aligned** (Lee, 2004).

An agile supply chain aims to respond quickly to short-term changes in both demand and supply flows. To achieve this goal, the solutions need to consider the use of anticipation strategies (activities postponement, strategic placement of inventory, and the anticipated structure of flexible and resilient logistics systems) in balance with the use of response strategies (contingency plans and crisis management teams).

To achieve the goal of adaptability, the supply chain needs to have the ability to adjust the structure of the chain (changes in partner relationships, supply strategies, use of technology) to improve service. This capability is developed through the monitoring of risk areas and the potential use of intermediaries to bring flexibility to the supply chain.

Finally, the alignment objective seeks to develop incentives that aims to unify the efforts of those responsible for both supply and demand to achieve a desired performance.

The application of a framework, developed considering the characteristics of agility, adaptability and alignment, is the core of this study. The private sector can and should learn these skills with crisis management to better achieve the strategic outcomes in social, environmental and economic terms.

In recent decades, companies have focused their efforts on increasing speed and reducing costs. This trend of acceleration can be exemplified by the emergence of commercial arrangements such as lean manufacturing, agile production, cycle time compression, etc. Examples commonly found are including Just-in-Time (JIT) and the Efficient Consumer Response (ECR). The focus of these arrangements on speed can serve as experience for planning and organizing operations in crisis situations. However, focusing only on the goals of acceleration and cost minimization does not ensure a long-term competitive advantage. Supply chains can be fast and efficient in terms of cost management but still have difficulties in making structural changes in light of market changes.

Thus, studying crises can improve how sustainability and resilience are managed in traditional supply chains. The global nature of humanitarian agencies – including the notably capabilities of agility, adaptability, and flexibility – can be a trove of information for global supply chains. These chains have longer performance cycles that are more uncertain than domestic chains, being more susceptible to uncertainties, interruptions, delays, and greater risks.

The academic reference assumes that both processes and their relevant performance measures need to be aligned with different types of crisis situations. Although there are different classifications of disasters and types of crisis, a generic conceptualization considers the probability of the event happens, the period that the event remains present (including the magnitude / impact of the event itself), and

how the system recovers after presence of the event. Using this approach, the combination of these factors characterizes a broad framework, as seen in Figure 2.

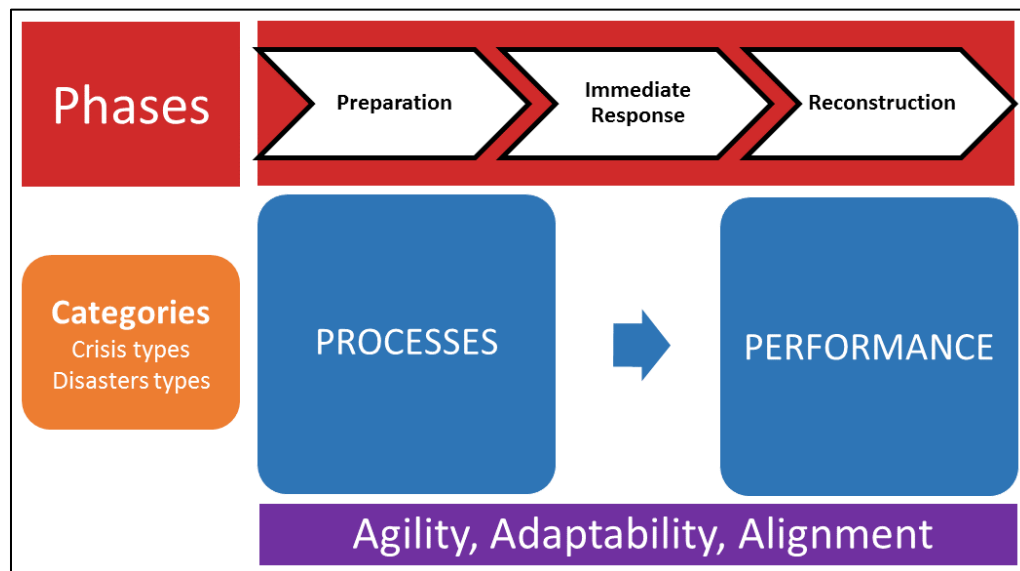


Figure 2: Academic Framework – Logistics in Crisis Situations

Crisis logistics management can be divided into stages, where each set of processes and their performance metrics have different priorities in each phase. Generically, three distinct phases are specified: **(1) preparation, (2) immediate response, and (3) reconstruction**. As disasters are fluid in nature, the framework to measure them by must be too.

While all logistics activities are present in all phases of crisis management, the focus of each phase is different. In the preparation phase, planning is critical, both of prevention measures and of evacuation plans. During the response phase, the rapidity with which basic survival items (such as water, food, hygiene items and medicine) can reach victims is the focus; the quicker this is done, the more lives that can be saved. In the reconstruction, logistical support focuses on the optimization of scarce resources that are available to rebuild. From the reconstruction phase, the circle continues as preparation and anticipation of the next event occurs.

The preparation phase mainly involves risk mitigation (to prepare for a disaster) and risk response (to respond when a disaster is imminent). The definition of the term *mitigation* by the International Strategy for Disaster Reduction (ISDR) of the United Nations is "the reduction or limitation of the adverse effects of threats and related disasters". Risk mitigation focuses on preparing plans for disasters that typically occur in a particular region. For example, the Gulf Coast must have evacuation plans in place during hurricane season, as these disasters occur regularly. Risk response focuses on preparing in the present for when a future disaster will occur. Staple items, such as water, medicine, and blankets, can be stored in geographically-centered locations for rapid dispatch in the immediate aftermath of a disaster. Some humanitarian agencies buy such items so often that traditional supply chain relationships form between the organizations and their supplies.

Once a crisis event occurs, the plans created by aid agencies are put into practice. The first 72 hours of the disaster are critical. Large-scale disasters require a quick response from a set of actors who must

work together to create a supply chain that provides the necessary goods as quickly as possible. In the chaos of the disaster, however, action plans are often not followed, and the lack of coordination between responding organizations creates a chaotic situation.

When the initial team arrives in the disaster zone, an initial assessment is conducted of the extent of the damage and the number of people affected. This assessment is the basis for creating lists of specific items and quantities needed to provide relief to the affected populations. The information is often quite uncertain, leading to decisions based upon estimates and assumptions. When supplies do arrive, local logistics (including transportation, storage, and distribution) must be handled in a unique way. Finally, the reaction of the local government greatly impacts the response.

When these complexities are multiplied with the presence of multiple disaster relief organizations, the situation often becomes more complex than is manageable. The cooperation between actors becomes a critical factor. To promote a mechanism for coordination between aid agencies in large-scale disasters, the United Nations created the United Nations Joint Logistics Center (UNJLC), which brings together key partners within and outside the UN, in order to increase aligning operations.

While the immediate aftermath of a disaster is often the most famous portion, arguably the most important portion is the recovery phase. As large-scale disaster can substantially affect housing, food production, and local infrastructure, slow onset disasters such as famine or epidemics can be triggered. The recovery phase of disaster response must prevent these disasters from occurring and focus on the long-term well-being of the population. This phase is guided by resource constraints: within severely-lacking regions, homes, bridges, and hospitals must be rebuilt; family and friends must be reunited; food must be economically available; and the local economy must have the roots to recover.

Finally, the recovery phase is the launching point for the preparation phase of the next disaster. Using lessons learned, actions plans can be updated and risks mitigated to better prepare for the next event.

As important as the recovery phase is, however, it is the stage that receives less attention from scholars and the media. Consequently, the number of donations is reduced, further impacting the disaster relief efforts.

Processes: What Activities are Performed

The academic framework on which this paper is based is aligned with the traditional concepts of business administration. A process is the set of activities to generate predefined results, since the origin of the need to the delivery of the product to satisfy the need. Any organization, small or large, is a living system in which entities (suppliers, customers, employees, products / services / information) and basic functions (production, marketing and sales, finance and accounting, human resources, logistics) coexist and interact. To achieve the success of the operations, it is necessary to identify and create plans, determine their priority, and describe their procedures that meet the required needs.

These processes can be combined into the of business functions. Once these functions have been defined and broken down properly, they are stable over time and applicable in a variety of situations. Thus, the functions can act as a reference point between different operations that might otherwise exhibit significant variations.

The activities that make up a function are related to each other by "affinity" because they work a common set of data entities or because they are sequential or parallel in carrying out the work

associated with a common final result. Suitable functional decomposition must take into account established principles and guidelines, which may be, for example:

- Functions must be identifiable and definable in terms of activities, responsibilities and duties;
- Functions must be as independent as possible of the existing organizational structures;
- Functions must, as a group, form a set that is essential to the life cycle of the "system";
- Each resulting subset of functional decomposition must represent a "social and technological subsystem" by itself (referring to people and technology).

Each function is a complete sequence of multiple processes; it is triggered by some event and has a significant (preferably customer-focused) outcome for the business. If a function consists of activities that play a role or reason to exist in the organization, business processes "perform" individually or in combination with these activities to perform the work of a particular function. Thus, the activity represents the functional unit (which will serve as a component of business processes, a cross-functional view) that allows identification of common "utilities" and opportunities for reusing functional.

In addition to the previously presented concepts, the proposed reference model is mainly based on the phases proposed by Kovács and Spens (2007) and the conceptual model of 21st Century Logistics Bowersox, Closs and Stank (1999) (Kovács & Spens, Humanitarian logistics in disaster relief operations, 2007; Bowersox, Closs, & Stank, 2009). For each phase of the logistics management in a crisis situation, three contexts or dimensions (Operational, Planning/Control, and Behavior) obtained from reference 21st Century Logistics are tailored to the management in crisis situations.

Thus, the proposed reference identifies processes, constraints, skills and resources, called "items" of each phase, seeking the improvement of logistics management performance in crisis situations.

Regarding the **Preparation** phase, the processes and activities considered seek information for the following questions:

- Have surveys been conducted about the standard and the risks of natural disasters in the region?
- Are there efforts to prepare a response in case of a disaster occurs?
- Are the available equipment and resources adequate for the expected disaster?
- Are the processes standardized and simplified?
- How was designed the capacity of the structure?
- Are there agreements with critical material suppliers?
- How is the information management performed?
- What are the available means of communication?
- Are there warning systems to notify the public about possible occurrences?
- Are there any collaboration in the planning phase between organizations which can provide assistance to the crisis?
- Are there pre-defined metrics to measure performance?
- Were the roles and responsibilities clearly defined?
- Are there information sharing arrangements and resources between organizations?

Table 4 presents for each Context (Operational, Planning and Control, Behavioral) the breakdown of processes and activities needed to address the further questioning during the **Preparation** phase.

21 st Century Logistics Model	Preparation
Operational Context	- Integration with population in risk areas: • Identification of the region's needs, considering the disasters that typically occurs; • Programmed response capacity; • Flexibility of people and tools to other disasters; - Internal integration for disaster preparation: • Process view within the organization; • Standardization and simplification of the process; • Structural adjustment capacity in the event of new needs; - Integration with suppliers: • Development of strategic partnerships with suppliers.
Control and Planning Context	- Integration between technology and planning (Preparation): • Information management forms; • Available media; • Available Warning systems; • Collaborative planning between organizations; - Integration of performance measures (Planning): • Determination of metrics for performance evaluation.
Behavioral Context	- Network Integration (Comprehension of responsibilities and action plan): • Clear determination of responsibilities; • Agreements of sharing information and resource;

Table 4: Processes – Preparation

Regarding the second stage, **Immediate Response**, processes and activities seek to address the following questions:

- How does the initial assessment of the disaster take place?
- Are the organizations able to provide an appropriate response?
- Do organizations prove to be flexible to respond to the disaster?
- Does the process flow occur efficiently?
- How does the structure adapt to crisis events?
- What is the role of the suppliers for the answer?
- Can you rely on the operational capacity of suppliers to support the management of the crisis?
- How the management of suppliers is carried out?
- How is the information management performed?
- Which are the media used?
- Is any warning system used to warn the population?
- Is there collaboration between providing relief organizations or immediate assistance?

- Is performance assessed within organizations?
- Are the roles and responsibilities defined respected during the crisis?
- Are Information and resources shared between organizations?

Table 5 presents the breakdown of processes and activities needed to meet the further questioning for each Context (Operational, Planning and Control, Behavioral) during the **Immediate Response** phase.

21 st Century Logistics Model	Immediate Response
Operational Context	- Integration with victims: • Same region needs which were identified in the preparation phase; • Earned responsiveness; • Presented flexibility; - Internal integration in the chaos moment: • Procedural flow as planned; • Adaptation of the structure to the disaster in question; - Integration with suppliers (Action): • Supplier Responsibility as specified; • Operating melting capacity with suppliers; • Suppliers Management;
Control and Planning Context	- Integration between technology and planning (Action): • Information management forms; • Available media; • Available Warning systems; • Collaborative planning between organizations; - Integration of performance measures (Results): • Performance evaluation.
Behavioral Context	- Network Integration (Compliance with responsibilities and action plans which were set.): • Responsibilities held as planned; • Information and resource shared;

Table 5: Processes – Immediate Response

Finally, regarding the last phase of **Reconstruction**, the specific processes and activities seek to answer the following questions:

- Is there an elaborate plan of reconstruction/recovery of the region?
- Is there planning for the participation of the responsible organizations in the recovery phase?
- How does the crisis management structure respond to the reconstruction phase needs?
- How is the participation of suppliers?
- How information management in this phase is carried out?
- Which media are used?
- Is there a plan for review/recovery of warning systems for the population?

- Is there collaboration between organizations that stage?
- Is the aim improve the evaluation/performance measurement?
- Were the roles and responsibilities reviewed?
- Is the aim improve the sharing of information and resources between organizations?

Table 6: Processes – Reconstruction summarizes the breakdown of processes and activities needed to meet the further questioning for each context during the **Reconstruction** stage.

21 st Century Logistics Model	Reconstruction
Operational Context	- Integration with beneficiaries of help: • Treatment to needs in recovery regions; • Participation in the final phase; - Internal integration to recovery: • Adaptation of the structure to recover the region; - Integration with suppliers (Action and Improvement): • Suppliers Participation;
Control and Planning Context	- Integration between technology and planning (Improvement): • Information management forms; • Available media; • Available Warning systems; • Collaborative planning between organizations; - Integration of performance measures (Improvement): • Performance evaluation.
Behavioral Context	- Network Integration (Action and improvement): • Adaptation of responsibilities; • Information and resource shared;

Table 6: Processes – Reconstruction

Performance: How Activities are Measured

Despite of the importance of humanitarian supply chains and their response to disasters, there is a lack of performance measurement systems developed to quantify the success of relief operations. This is a major limitation of this area of knowledge, particularly in response to developments made in the business sector. Without a proper method of measuring performance (and comparing it to historic performance once data is gathered), improving the organizational response to disasters is weakened. The old adage of “if you can’t measure it, you can’t manage it” holds true here.

Several factors make performance measurement a difficult task for organizations in crisis. The characteristics of the operating environments in which these organizations operate increase the level of complexity. This chaos extends to measuring the performance of the organization. Additionally, the relatively short duration for which these supply chains operate prevent reputable data from being gathered. Effective performance evaluation systems would help professionals in their decision-making process, increasing the efficiency and effectiveness of relief operations.

Some promising efforts in the development of specific performance measurement systems for logistics in crisis situations consider multiple factors. Commonly, existing models of performance evaluations in the business context have been adapted by considering the specific characteristics of humanitarian environment (Beamon & Balcik, 2008). Resource utilization indicators, performance indicators (efficiency), and flexibility indicators are included among the dimensions of performance that are commonly deployed. **Thus, current efforts to performance measurement systems seek to measure the levels of effectiveness and efficiency, as well as the response and adaptation skills in a dynamically unstable environment and high level of restrictions.**

After reviewing the literature and conducting relevant case studies, this study utilizes the following performance evaluation measures for the logistics management of crisis situations (Table 7). The dimensions are generic and comprehensive in nature; specific metrics must be developed for each type of emergency.

Performance of Logistics Management in Crisis Situation		
Preparation	Immediate Response	Reconstruction
• Identification of disasters in the region and their possible damage • Development of contingency plans and evacuation which are comprehensive and viable • Integration between functional areas • Standardization and simplification of processes • Integration Agreements and development of strategic partnerships with suppliers • Implementation of management information systems • Implementation of media and warning systems • Collaborative planning among organizations • Establishment of metrics and performance goals • Clear determination responsibilities • Establishment of agreements to share information and resources	• Initial disaster evaluation • Ability to assist victims • Procedural flow efficiency • Ability to adapt to the event in question • Operating melting capacity with suppliers • Supply management capacity • Information Management Capacity • Media and alert systems used • Collaboration and exchange of information between organizations • Response performance against defined goals • Adherence to the responsibilities planned • Sharing information and resources	• Meeting the needs of the region in reconstruction • Meeting the needs of the affected population • Integration between the competent organizations for reconstruction • Supply management capacity • Information Management Capacity • Review and recovery of media and warning systems • Collaboration and exchange of information between organizations • Review metrics and performance goals • Review of responsibilities • Sharing information and resources

Table 7: Measures of Performance in Crisis

Despite current efforts, the challenge for performance systems is to consider specific issues such as: types and quantities of resources, procurement methods and storage of materials, tracking tools and alternative forms of transport to regions in crisis, specialization of participants in the Immediate Response stage, and the cooperation plan between the teams. Such questions are central but complex to be built and developed.

Systems in crisis situations can be seen as supply chains operating in extreme disruption scenarios. Operations need to be performed in a flexible environment and extreme agility in chain for uncertain accommodations.

The next section presents a description of the specific case study. The objective is to provide an overview of the disaster before the academic framework is applied.

The Events of the Gatlinburg Wildfires

Wednesday, November 23

While responding to a report of a vehicle fire at approximately 17:00, National Park officials discovered smoke rising near the Chimney Top peaks in the Great Smoky Mountain National Park. Due to both treacherous terrain and impending nightfall, both officials left the area. At this time, “the smoldering fire was estimated to be less than one acre in size” (Division of Fire and Aviation, 2017, p. 9).

Thursday, November 24

On Thursday, Thanksgiving Day, NPS officials again visited the site of the Chimney Tops 2 fire. It was determined that “the fire had only grown slightly in size from the day before and there was no active flame or fire, except the smoldering duff, which had caused the fire to only slightly increase in size” (Division of Fire and Aviation, 2017, p. 10) .

To contain the fire, a “box” was developed using natural features of the National Park and, to a lesser extent, human-constructed fire lines. Construction on these lines did not begin in earnest.

The *Knoxville News Sentinel* reported that “sixty-two active fires are currently burning” in the East Tennessee area, mostly driven by low rainfall. It states that a “code red” air quality alert was issued for the Knoxville region (Dorman, 2016).

Friday, November 25

The area near the fire was scouted to work on the “box” to contain the wildfire. The fire had made no notable increase.

The *Knoxville News Sentinel* published an article providing an overview of the burning wildfires in the East Tennessee area. The Chimney Tops 2 fire is mentioned halfway through the article, stating that trails in the area are closed until further notice and that wood or charcoal fire are not permitted in the park (News Sentinel staff, 2016).

Saturday, November 26

No real changes in the behavior of the fire was reported. NPS officials “still believed that they could catch and hold the fire in the drainage bottoms using a containment strategy of natural and human-made features”. At the same time, however, officials in the area “recognized that the vegetation, terrain and conditions in the area were also unsuitable for direct fire line construction” (Division of Fire and Aviation, 2017, p. 13).

In the early morning hours, multiple weather forecasts were issued. All referenced expected high winds in the Park on Monday, November 28 (Division of Fire and Aviation, 2017, p. 12).



Figure 3: Fire activity on Saturday, November 26
(Division of Fire and Aviation, 2017, p. 13)

Sunday, November 27

In the early morning hours, the National Weather Service's Morristown (NWS-Morristown) office issued multiple weather forecasts for the Gatlinburg area. They both forecasted high wind gusts on Monday. A "Special Weather Statement" was issued at 09:03 on Sunday morning, followed by an "Urgent Weather Message" at 14:52. Both of these noted high winds; the morning statement warned of "enhanced fire danger" due to "critically dry conditions", low relative humidity values, and high winds. Three more briefings were sent throughout the day (News Sentinel staff, 2016).

Upon arriving at the fire on Sunday morning, it was determined that the fire had expanded overnight. The National Park service began taking a more active role in attacking the fire. Multiple assets, including additional personnel, fire engines, and various types of aircraft, were requested. Throughout the day, aerial water drops were made on the fire. Along the Chimney Tops trail, NPS crews worked to create fire lines in the effort to "box" out the fire. After nightfall, it appeared that the fire was smaller; an NPS official "described how 'you couldn't even see the fire except for a couple glowing areas.'" (Division of Fire and Aviation, 2017, p. 15).

Monday, November 28

Additional forecasts from NWS-Morristown were released in the early hours of Monday, again warning of "strong gusty winds" ahead of a cold front. A previously-released "High Wind Watch" was rescinded, replaced by a "High Wind Warning" (News Sentinel staff, 2016).

After a radio call from NPS maintenance crews at 07:01, NPS officials arrived at the Chimneys Picnic Area, approximately one-half mile from the fire's perimeter on Sunday evening. The fire had spread to the vicinity of the picnic area; the fire was now estimated to be 250-500 acres in size. Additionally, a spot fire was detected across Newfound Gap Road. The captain of the Gatlinburg Fire Department was contacted about potential smoke in the city of Gatlinburg (Division of Fire and Aviation, 2017, p. 17).

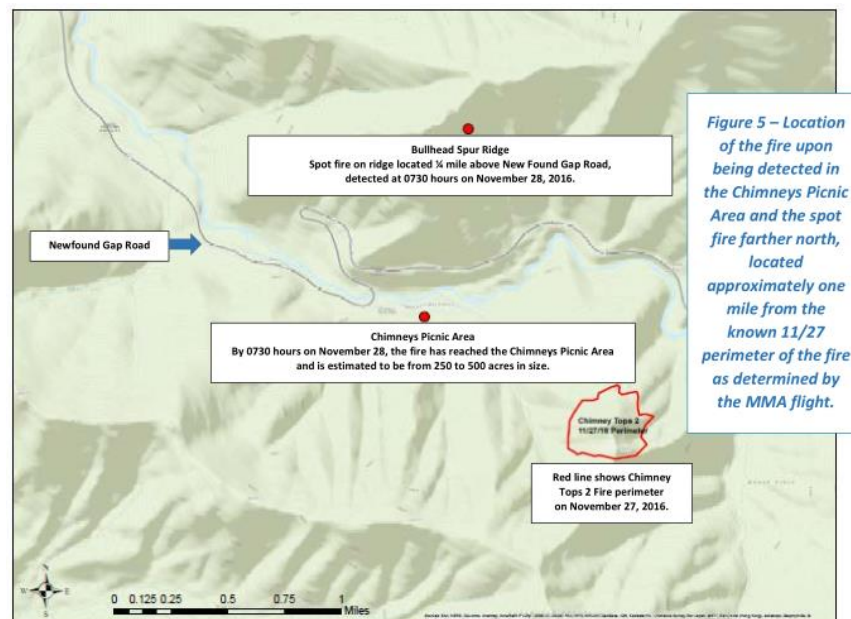


Figure 4: A map of the impacted area.
(Division of Fire and Aviation, 2017, p. 17)

At 11:00, reports of an additional fire at the Twin Creeks Picnic Pavilion – a recreational spot and park facility located approximately 1.5 miles from the Gatlinburg city limits – began to surface. As there were no other sources of ignition, it was believed that the Twin Creeks fire was a spot fire of the Chimney Tops fire. Twin Creeks is located close the Mynatt Park neighborhood in the city of Gatlinburg (Division of Fire and Aviation, 2017, p. 19).

All NPS resources (except one) and Gatlinburg Fire Department (GFD) resources converged on Twin Creeks to fight the fire. Aerial resources were unable to fight the blaze because of rough winds. New reports detailed potential fires that were spurs of the original. The Gatlinburg Fire Department issued a countywide request for mutual aid (News Sentinel staff, 2016).

In a meeting of multiple stakeholders in late morning – including NPS officials, Gatlinburg and Pigeon Forge fire chiefs, and the Gatlinburg city manager – the protection of Mynatt Park became the focus of the fight. It was decided at this time to begin advising residents of the Mynatt Park neighborhood of a voluntary evacuation (Division of Fire and Aviation, 2017, p. 21). This began at approximately 12:00 (News Sentinel staff, 2016).

By this time, the city of Gatlinburg had been engulfed in smoke from the fires. At 11:21, the National Park issued an Air Quality Advisory, stating that the air was “unhealthy” but that “[t]he fire currently poses no immediate threat to ... any areas outside of park boundaries including Gatlinburg ...”. Due to the smoke, Pi Beta Phi Elementary School, located in downtown Gatlinburg, was evacuated at 12:30. At 13:48, the Gatlinburg Community Center, located northwest of the downtown area, was opened as an evacuation shelter. The East Tennessee chapter of the American Red Cross managed the site (News Sentinel staff, 2016).



Figure 5: A view of downtown Gatlinburg on Monday, November 28 (Paciorka, 2016)

Firefighters continued to fight the Mynatt Park / Twin Creeks fire throughout Monday afternoon and into early evening. Due to the movement of the fire into the Gatlinburg area, the GFD began to play a larger role in the fighting of the fire. In the early evening, wind speeds increased; the Gatlinburg Fire Chief would later state that the “wind speeds doubled” around 18:00 (News Sentinel staff, 2016).

At some point after 17:00, the fire began to also move toward the headquarters of the Great Smoky Mountain National Park, located just inside the park boundary with the City of Gatlinburg. Within an hour, reports began to surface that the fire had moved to the nearby Ski Mountain Road area of Gatlinburg. 911 logs confirmed that multiple structures were burning in Gatlinburg (Division of Fire and Aviation, 2017, p. 23)

At approximately 18:00, the City of Gatlinburg issued an “immediate mandatory evacuation” of the Mynatt Park neighborhood, among others, due to the fire. This was not communicated by the City of Gatlinburg until a 21:38 news release, however (News Sentinel staff, 2016). It was reported at this time

that portions of the “Spur” – the portion of highway US-321 that connects Gatlinburg with nearby Pigeon Forge – was burning (WBIR Staff, 2016).



*Figure 6: Fire approaches cars leaving Gatlinburg.
(Pinyan, 2016)*

At 18:30, a statewide request for mutual aid was issued by the GFD, with a news release from the City of Gatlinburg following, stating that the GFD and the Tennessee Division of Forestry was working to protect the Mynatt Park neighborhood.

At approximately 20:30, Sevier County officials tried to contact the Tennessee Emergency Management office in Nashville to have a Wireless Emergency Alert sent to cell phones announcing the mandatory evacuation of the city. Due to a communication issue, this alert was never sent. Using the city’s emergency siren system, however, a message was communicated. At 21:03, the NWS-Morristown issued an evacuation message through local television and radio stations. This evacuation was expanded to certain portions of Pigeon Forge at 23:47 (News Sentinel staff, 2016).

At 23:00, the Tennessee Emergency Management Agency (TEMA) released an update, stating that 30 structures were on fire in Gatlinburg with evacuations underway. At that time, a command center had been established at Gatlinburg City Hall. Additionally, 1,200 people had been sheltered at the Gatlinburg Community Center and Rocky Top Sports Park (TEMA, 2016).

Because of the deteriorating conditions within Gatlinburg, it is impossible to create an exact timeline on Monday night / Tuesday morning. Access to the City of Gatlinburg was closed; any reporting was done by journalists outside of the city.



Figure 7: Arrowmont Crafts School in downtown Gatlinburg burns.
(Ham, 2016)



Figure 8: People evacuate the city of Gatlinburg.
(TN Highway Patrol, 2016)



*Figure 9: The Wedding Chapel burns in Gatlinburg.
(James, 2016)*



*Figure 10: Tennessee State Troopers escort residents out of Gatlinburg.
(TN Highway Patrol, 2016)*



Figure 11: Fires illuminate hills in the Smoky Mountains.
(Pete MichaelsTraffic, 2016)

Tuesday, November 29

Additionally, two other evacuation centers were opened around midnight, both in Pigeon Forge (Red Cross East TN, 2016). Other locations, including churches in Pigeon Forge / Sevierville and farms in the area, were made available for both human and animal evacuees (Knoxville Police Department, 2016).

A 03:00 release by TEMA expanded the number of impacted homes to 100 and the number of impacted structures to 30 but otherwise provided no new information (TEMA, 2016). At 04:37, WBIR reported that 75-100 homes had been destroyed in Cobbly Nob, a neighborhood located east of downtown Gatlinburg (WBIR, 2016).

TEMA released another update at 08:00; it stated that over 1,400 residents and visitors evacuated Gatlinburg during the night (TEMA, 2016). The latest estimate placed 1,100 in four shelters operated by both the Red Cross and other organizations.

At a morning press conference, Gatlinburg officials shared that 150 structures had been destroyed, but that the downtown region, including the popular Ripley's Aquarium of the Smokies and Pi Beta Phi Elementary School, remained intact. WBIR also reported that the number of people being served at Red Cross shelters is at 2,000 (WBIR Staff, 2017).

At this press conference, officials urged residents not to return until the "emergency phase" was over. Further, a curfew was placed on the city from 18:00 on Tuesday to 06:00 on Wednesday (WBIR Staff, 2017).

A 17:00 update from TEMA updated the number of operating shelters to three (all operated by the Red Cross) and, for the first time, reported three fatalities. The news release specifically mentioned that the Red Cross was accepting cash donations and the New Hope Church of God was accepting donations also. It also specifically mentioned a request from Gatlinburg officials that volunteers not self-deploy to Sevier County (TEMA, 2016).

Wednesday, November 30

Strong storms were forecasted to move into the area, bringing some much-needed rain to combat the fires that were still burning. According to WBIR, minor flooding could be a concern due to the forecasted rainfall amount (WBIR Staff, 2017).

A morning news conference confirmed that a fourth body had been found in the Gatlinburg area. An afternoon press conference raised the death toll to seven. Three people had been rescued from two different locations in the city of Gatlinburg. Officials were in the process of checking homes throughout Gatlinburg, as the public was not allowed back into the city limits; they had completed approximately 30% of homes by the afternoon press conference.

The American Red Cross, at the afternoon press conference, announced that the number of operating shelters had been reduced from two to one (WBIR Staff, 2017). This report conflicts with a press release from TEMA, which stated that two shelters, down from three, were operating (Pigeon Forge Community Center and Rocky Top Sports World) (TEMA, 2016).

A water boil remained in effect, as did a curfew for the city (WBIR Staff, 2017).

A TEMA press release stated that a call center for donations and volunteering had been set up (TEMA, 2016).

Dolly Parton, the famous entertainer born-and-raised in Sevier County, announced the creation of the Dollywood Foundation My People Fund, which would go on to provide monthly \$1000 checks – with no strings attached – to families whose “homes [were] uninhabitable or were completely destroyed” by the wildfire (The Dollywood Company, 2016).

Thursday, December 1

While the city of Gatlinburg remained closed, city leaders were hoping to open the city to property owners by Monday, December 5. In the meantime, rescue crews were still diligently working the city in rescue and recovery efforts (WBIR Staff, 2017).

Officials also discussed the creation of an electronic map to show damaged or destroyed properties (WBIR Staff, 2017). A TEMA release stated that “more than 400 firefighters and 100 fire apparatuses [were] supporting the firefighting effort in Sevier County” (TEMA, 2016).

At an afternoon press conference, the number of victims was increased to 10 (WBIR Staff, 2017).

It was also announced that “homeowners, renters, and businesses from evacuated areas that have been closed will be allowed Friday to go back up to check on their properties” (WBIR Staff, 2017). Access would be open only to verified residents (and insurance adjusters) from 10:00 until 17:00. TEMA reported that an estimate 700 local structures were burned (TEMA, 2016).

In the evening, Governor Bill Haslam’s office announced a declaration of a “state of emergency”, resulting in a suspension of a number of state rules and laws, in an effort to relieve suffering from the wildfires. Among the suspended rules/laws include (WBIR Staff, 2017):

- Health care professionals licensed outside of Tennessee could be permitted to practice if assisting survivors or evacuees.
- Within certain counties (including all of the affected areas), pharmacists could distribute 14-day supplies of prescriptions without proper authorization to survivors or evacuees.
- Residency requirements for state health programs were suspended for survivors or evacuees.
- The Tennessee Department of Safety and Homeland Security could waive fees for duplicate driver licenses.

An evening press release from TEMA raised the death toll to 11 fatalities. It was further reported that two Red Cross shelters remained open with 266 total occupants (TEMA, 2016).

Friday, December 2

At a Friday morning press conference, the death toll was again raised, this time to 13 (WBIR Staff, 2017).

At an afternoon press conference, Sevier County Mayor Larry Walters said that “search and recovery crews were expected to finish a ‘soft search’ of all fire-affected areas of Sevier County and Gatlinburg by 7 p.m. Friday” (WBIR Staff, 2017).

As announced on Thursday, December 1, residents and property owners were allowed into the city on Friday. The access would continue through Tuesday, it was announced. City manager Cindy Ogle stated that it was “hoped that all roads in town [would] be open to the public Wednesday” (WBIR Staff, 2017).

An afternoon press release from TEMA lowered the number of occupants in Red Cross shelters to 195 in two facilities (TEMA, 2016).

For the first time, a central distribution center for relief supplies for those affected by the fires was announced. The location, a former entertainment venue located on the Gatlinburg-side of Pigeon Forge, would be open during regular business hours (WBIR Staff, 2017).

Additionally, a central hub for those interested in volunteering with recovery efforts was announced. Volunteer East Tennessee was announced as the organizer of volunteer efforts (TEMA, 2016).

Saturday, December 3

A joint news release from multiple organizations (TEMA, Sevier County, City of Gatlinburg, and NPS) provided the following figures:

- 13 confirmed fatalities
- 100 individuals injured as a result of the fire
- 1,413 structures damaged or destroyed

At the time of the release, 605 personnel were fighting the Chimney Top 2 fire.

Much of the events of Saturday were a continuation of Friday: evacuated areas were accessible from 10:00 to 17:00 daily, a curfew was imposed from 18:00 to 06:00 daily, and a water boil advisory was still in place.

In the same news release, officials released details concerning efforts to inform the public of the threat the wildfires posed. Of particular note is the fact that a text message with an evacuation order was supposed to have been sent; because of phone, internet, and electrical issues caused by the fire, this request was never received. Once contact “was reestablished, TEMA was able to send a mobile message later in the evening ... asking Sevier County residents to stay off mobile devices except for emergency use” (Sevier County; City of Gatlinburg; Tennessee Emergency Management Agency; Great Smoky Mountain National Park , 2016).

Recovery

On Sunday, December 4, a 14th person was confirmed dead as a result of the fires. The death count would not rise again (WBIR Staff, 2017).

On Tuesday, December 6, the footprint of the water-boil advisory shrank to a few neighborhoods in Gatlinburg (WBIR Staff, 2017). On this day, Sevier County launched a recovery website and hotline. Dubbed “Mountain Tough”, the website and hotline provided a centralized location for coordinating monetary and in-kind donations, enlisting volunteers for recovery efforts, and viewing an updated map of the fire damage (TEMA, 2016)

On Wednesday, December 7, residents were able to begin occupying their properties within Gatlinburg. On the same day, two juveniles were charged with aggravated arson “for setting the Chimney Tops 2 fire in the Great Smoky Mountains National Park that spread into Sevier County last week”. Officials also confirmed that they were seeking a presidential disaster declaration for the county (WBIR Staff, 2017). Another joint press release gave residents information about ash cleanup, water discoloration, and the

resources available at Boyd's Bear Distribution Center (previously mentioned as the central distribution center) (Sevier County, City of Gatlinburg, Tennessee Emergency Management Agency, 2016).

On Thursday, December 8, damage assessments were completed: a total of 2,460 structures were either damaged or destroyed. Both Red Cross shelters remained open, with 112 occupants between the two (WBIR Staff, 2017).

From December 9 – 11, the American Red Cross of East Tennessee provided cleaning supplies to residents at three different distribution points (MountainTough, 2016).

On December 12, a resource center, staffed by representatives from multiple state agencies and relief organizations, was opened in Pigeon Forge (MountainTough, 2016).

On December 15, it was announced that Sevier County would receive federal disaster aid after a Presidential Disaster Declaration was made (TEMA, 2016). A follow-up press release from TEMA urged residents to register with FEMA (Federal Emergency Management Agency) (TEMA, 2016).

In late December, the Red Cross said that there were 3,066 overnight stays at shelters throughout Sevier County, manned by 405 volunteers. At Rocky Top Sports World, a primary shelter within Gatlinburg, there were 1,200 victims in the facility on the night of November 28th (Ahillen, A month after historic fire, Gatlinburg rebuilds, 2016).

Additionally, in late December, the mayor of Sevier County Larry Waters indicated that he would like to be involved in future decisions to be made concerning evacuations (Ahillen, A month after historic fire, Gatlinburg rebuilds, 2016).

In January 2017, commissioners with the City of Gatlinburg "passed resolutions ... to allow speedy reconstruction of houses just as they were, even if more than half-burnt, and to let owners live in campers on-site while their houses are rebuilt" (Gaines, 2017). Some residents, however, remarked that these restrictions were not as easy as they should be.

In February, Boyd's Bear Distribution Center, the central point of reference for the distribution of thousands of donated in-kind items, was closed. Remaining donations were given away to local charities (Webb, 2017).

Also in February, the Mountain Tough Recovery Team was established to "focus ... on homeowners who either did not have insurance or did not have enough insurance to cover the damages". It was designed to support the community in the long-term, once short-term relief organizations left (Boehnke, 2017).

In May, the last of the checks from the Dollywood Foundation's My People Fund were distributed. Fundraising projections were above established goals, so the final check given to eligible families was \$5000 (Ahillen, Dolly Parton's 'My People' money paid off for those who lost homes in fires, study shows, 2017).

Also in May, new sirens were activated in the downtown Gatlinburg area as the first step of an upgraded emergency management system (Jacobs, 2017).

In August, Gatlinburg officials announced that installation of additional sirens throughout areas affected by the fires, including North Chalet Village and the Spur (Jacobs, 2017). Additionally, Sevier County upgraded its subscription to CodeRed, an emergency notification system designed to send both phone

and text alerts to enrolled residents. It is able to also be used by the National Weather Service (Wade, 2017).

Additionally, TEMA approved Gatlinburg's application to access the Integrated Public Alert and Warning System (IPAWS), which allows Gatlinburg officials to send text messages to all cell phones within a certain region. Previously, TEMA officials in Nashville had access to this ability; Gatlinburg officials tried to contact TEMA in the middle of the wildfires. Due to communication issues, these requests were not received. Additionally, both the city and the Gatlinburg Police Department established official Facebook accounts (Jacobs, 2017).

It was also announced the county has "applied for a grant to print brochures with disaster information to be placed in every rental cabin", similar to brochures designed to provide information about bears in the region (Jacobs, 2017).

Finally, new reflective signs were investigated by the city to provide guidance about ways to evacuate from the confusing local roads (Jacobs, 2017).

In October, a new AM radio station was enacted to "alert residents and visitors about emergencies and dangerous situations". It was integrated with both new and existing emergency notification systems (Reigart, 2017)

Application of Academic Framework

The objective of this section is to apply the academic framework in the specific context of the case study described.

In light of this analysis being a case study – where full facts are not available – the previously-described framework will be applied simply to give a broad overview of the areas of strength and weakness. Each point from the academic framework will be graded on a 1-3 scale:

Rating	Description
1	Metric is present
2	Metric is somewhat present
3	Metric is not present
N/A	Cannot determine if metric is present; not enough information available

Table 8: Description of Rating System

Preparation

Metric	Rating
OPERATIONAL CONTEXT	
Identification of pattern of disasters in region and potential damage	2
Emergency plans exist, and are comprehensive / feasible	3
Functional areas integrated	N/A
Processes standardized and simplified	N/A
Integration agreements and development of strategic partnerships with suppliers	N/A
PLANNING & CONTROL CONTEXT	
Implementation of information management systems	N/A
Implementation of media and alert systems	2
Collaborative planning between organizations	2
Establishment of metrics and performance objectives	N/A
BEHAVIORAL CONTEXT	
Roles and responsibilities clearly outlined	2
Agreements exist establishing information and resource sharing	1

Table 9: Application of Framework – Preparation

From a city perspective, it appears that no serious preparations had been made, or at least communicated to the general public, for a disaster of this scale. While not verified in the course of this study, it is likely that emergency plans had been created by the city. The scope of these preparations is unknown, as is the perception of the reality of the threat. Regardless, it is relatively clear that this information was not effectively communicated to residents prior to the fire, regardless of the existence of any plans.

It appears that the infrastructure required to alert the community was a patchwork of multiple decades-old communicative systems. While they could certainly have been somewhat effective if used correctly (to be discussed in the “response” section), they appear to have lacked the scale to communicate information to all people in the region.

It is clear that relationships already existed between the city and other parties. This can be seen in the response to the early days of the fire; the Gatlinburg Fire Department responded, alongside the NPS, as the wildfire threatened Mynatt Park. A memorandum of understanding (MOU) existed between these two organizations in which mutual assistance would be provided (Division of Fire and Aviation, 2017, p. 33). Additionally, the quickness to which the Red Cross responded to establish emergency shelters shows that previous discussions had been held.

Response

Metric	Rating
OPERATIONAL CONTEXT	
Initial disaster assessment	2
Ability to care for victims	1
Procedural flow efficiency	N/A
Adaptability	2
Operational capacity with suppliers	N/A
Supply management capacity	N/A
PLANNING & CONTROL CONTEXT	
Ability to manage information	1
Means of communication and warning systems used	3
<i>Communication systems used to communicate to general public</i>	3
<i>Communication with media in immediate aftermath</i>	1
Exchange of information between organizations	1
Response performance against defined objectives	N/A
BEHAVIORAL CONTEXT	
Adherence to planned roles and accountability	2
Sharing information and resources	1

Table 10: Application of Framework – Response

During the actual event, first responders were quick to react to the wildfires. Within the city of Gatlinburg, officials fought whatever fires they could and worked to evacuate residents. Relief organizations – namely the Red Cross – responded very quickly and hospitably to care for those fleeing the fires. In the days after the fire, these organizations worked tirelessly to protect Gatlinburg: officials made a sweep of the entire city to check in all buildings. Victims were also cared for, both by disaster organizations and the people of east Tennessee (who flooded the area with in-kind donations).

It is well-known and well-reported that communication with the public at large, specifically the order to evacuate Gatlinburg. This is an area that must be improved going forward; it is clear that officials believe so as well. Once the fires had been contained and the immediate threat extinguished, communication drastically improved. Regular news conferences were held by Gatlinburg officials and regular press releases were written by TEMA.

Between the various involved organizations, there appeared to be clear delegation of roles and a sharing of information. Between the NPS and the Gatlinburg Fire Department, for example, there existed a memorandum of understanding that stated that the two organizations would assist each other when needed (Division of Fire and Aviation, 2017, p. 33).

Recovery

Metric	Rating
OPERATIONAL CONTEXT	
Meeting the reconstruction needs of the region	1
Meeting the needs of the affected population	1
Integration between reconstruction-focused organizations	2
Supply management capacity	2
PLANNING & CONTROL CONTEXT	
Ability to manage information	N/A
Review and recovery of media and alert systems	1
Organizational collaboration	N/A
Review of performance goals and metrics improvement used	N/A
BEHAVIORAL CONTEXT	
Review of roles and responsibilities	N/A
Sharing of information and resources	N/A

Table 11: Application of Framework – Recovery

As the city has progressed in the year since the fires, progress has been made to restore Gatlinburg to its former state. Aid from organizations, notably The Dollywood Foundation’s *My People Fund*, has had a clear, positive impact on the community. The relaxing of certain regulations has quickened the response.

Improvements have been or are being made to the city to improve alert systems going forward. The investment from the city into sirens, CodeRed, and reflective directional signage shows that officials understand the improvement that needs to be made.

Since many of the details concerning relationships between organizations are privy to those involved in the organization, this paper cannot report on much of the recovery efforts.

Recommendations

Going forward, there are two primary recommendations to be made to mitigate damage from future disasters in the Gatlinburg area: the development of initiatives for disaster preparation and better coordination between actors involved in the problem.

First, a mindset of disaster preparation must be instilled in the residents of the city. The city of Gatlinburg is a beautiful place, nestled right in the middle of beautiful mountains. This strength is also a weakness: there are relatively few ways to evacuate the city, and many of these routes are very dangerous roads. The forest that surrounds the city is susceptible to future fires, too. The recognized beauty of the city must be balanced by an awareness of the threats posed. The city and its residents must become aware of this reality. By doing so, they can continue to embrace the beauty of their home but also recognize its potential threat.

Second, better communication must be available. It is not the fault of any individual, but communication issues caused chaos during the peak hours of fire activity. This can be improved going forward by increasing the capability to communicate important information. Gatlinburg officials clearly recognize this. Infrastructure has been (and will continue to be) adopted to better communicate.

Conclusion

When the wildfires attacked the city of Gatlinburg in late November 2016, it awakened a fury from the affected townspeople. The city and region came together and quickly adopted the moniker “Mountain Tough”. In spite of the disaster they suffered, victims got up and started to rebuild. The mindset they embraced was and is beautiful.

This paper has studied academic literature on the proper role of logistics in disaster relief, examined a framework meant to measure responses to these events, and studied the day-by-day timeline as the fires struck Gatlinburg. The academic framework was then applied to the specific events of late November 2016 and a rating system was applied to judge the performance of all involved.

While both the preparation before the fires and the communication during the fires were lacking and should be improved, the humanitarian response to the fires was one of passion. Organizations and individuals alike rallied to help those victimized by the fires. Long-term recovery options will take time and be difficult, but will be done well. The academic framework provides the areas that require better development and further attention before the next disaster situation.

The people of Sevier County are special, as is their land. They will rebuild and be stronger than before. Have no doubt of that.

Study Limitations

Single case study analysis has been subject to a number of criticisms, the most common of which concern the inter-related issues of methodological rigor, researcher subjectivity, and external validity.

This study takes a purely qualitative look at the effect of the November 2016 wildfires on the Gatlinburg region. It relies entirely on secondary sources; no first-person accounts are used as sources. Additionally, the sources used come almost exclusively from media organizations, so internal information about the response of the fires is unavailable.

Finally, the application of the academic framework and recommendations come solely from the author, a college senior with no direct experience in disaster relief. Qualitative case studies are limited by the sensitivity and integrity of the investigator. The researcher is the primary instrument of data collection and analysis. Any claims and recommendations found in this paper should be taken lightly. The author encourages suggestions to improve the analysis and recommendations of this work.

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