EFFECTIVE PLANNING AND IMPROVISATION IN DISASTER RELIEF SUPPLY CHAIN MANAGEMENT

Joshua K. Strakos, University of Houston, 290A Melcher Hall, Houston, TX. 77204, jkstrakos@uh.edu, 785-393-0051
Wynne W. Chin, University of Houston, 280D Melcher Hall, Houston, TX. 77204, wchin@uh.edu, 713-743-4728

ABSTRACT

Within the past decade global disasters have taken a tremendous humanitarian and economic toll. Providing effective relief to the victims of these disasters requires efficient management of a quickly formed supply chain in the context of a rapidly changing and extremely uncertain environment. Supply chain management under these circumstances requires both planning and improvisation. In an effort to help organizations use scarce time and resources more efficiently, this research presents factors which may improve the effectiveness of planning and the incidence and effectiveness of improvisation in disaster relief supply chain management.
Keywords: disaster relief, supply chain management, improvisation, planning, performance

INTRODUCTION

In the past ten years, the cumulative toll of disasters to the world is staggering. For example, the statistics for meteorological disasters alone show the magnitude of the impact of this type of event on mankind[1]. Since 2002, there have been 950 meteorological disasters alone, with a death toll of over 171,000 people and over 381 million people affected. The cost of this type of disaster has been almost $475 billion during this same time frame, according to the Centre for Research on Epidemiology of Disasters (2011). The extent of the effects ranges from minor property damage, power outages, and infrastructure degradation to total property loss, loss of business and government continuity, injury, and loss of life. For a more thorough discussion of disaster classification and reporting criteria, see the Centre for Research on the Epidemiology of Disasters' International Disaster Database website at http://www.emdat.be/.

Once a disaster (natural or man-made) occurs, there is usually a sudden surge of public support due to the media coverage of an event. This support may come from individual donations, non-governmental organizations (NGOs), governments, individual volunteer time, etc. This initial surge, while well-intentioned, places an extreme burden on the disaster relief supply chain (myFoxAustin, 2011; WISH, 2011) by saturating available transportation capacity, storage space, and taking valuable labor hours for sorting and matching supplied items with demand. This disaster relief supply chain is itself conceived and activated immediately following a

[1] For a disaster to be entered into the database at least one of the following criteria must be fulfilled:
- Ten (10) or more people reported killed.
- Hundred (100) or more people reported affected.
- Declaration of a state of emergency.
- Call for international assistance.

disaster event. Better utilization of this support through management of the supply chain may enhance the ability of disaster relief supply to meet demand.

The purpose of this research is to help disaster relief organizations achieve more effective relief by identifying the factors which have the greatest effect on performance. Planning and pre-event coordination are discussed in the literature, however, successful disaster relief supply chain management will likely rely on a combination of planning and improvisation, which is a spontaneous and creative solution to an unplanned problem. Although several papers have addressed organizational factors which affect performance in terms of innovation and new product development, there have been no studies examining the role of improvisation in disaster relief supply chain management. This study will attempt to fill this gap by identifying the most important factors which lead to improvisation in disaster relief, the importance of these factors to performance, and by testing of the importance of critical success factors' direct impact on performance. Since as much as 80% of disaster relief is logistics cost, and disaster relief supply chains are conceived and designed rapidly, examining the factors which have the most effect on the performance of those supply chains has potential for great benefit to the entire relief effort through cost savings and increased speed of relief. Organizations will benefit from knowing important factors leading to improvisation, the importance of critical success factors to performance, and the impact of planning and capability related factors to the incidence and effectiveness of improvisation. In short, this research examines the how planning, improvisation, and factors instrumental in both mechanisms affect the performance outcome of disaster relief supply chains. This gives organizations with very limited time and resources the opportunity to recognize and focus on factors which will have the most impact on the success of a relief effort.

DEFINITIONS

The concepts involved in disaster relief supply chain management have been referred to as disaster supply chain management, humanitarian logistics (Kovács & Spens, 2007; Kovács & Spens, 2011), disaster operations management (Altay & Green, 2006), and public sector or humanitarian operations research (Ergun, Karakus, Keskinocak, Swann, Villarreal, Cochran, Cox, Kharoufeh, & Smith, 2010b). 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" (Thomas & Kopczak, 2005).

Disaster relief supply chains are treated as a subset of humanitarian supply chains, with all aspects of supply chain management included, rather than just logistics functions. Disasters necessarily involve a rapid and sudden onset with no advance warning or advance information, whereas some humanitarian supply chains deal with more of a steady state environment (such as food bank supply chains) (Whybark, Melnyk, Day, & Davis, 2010). This research will focus on disaster relief supply chains specifically and I will use the umbrella term of disaster relief supply chain management throughout this research.

Commercial supply chain management has been defined as a process which involves the flows of information, materiel, and finances and the management of these flows from raw material to the end user (Kovács & Spens, 2007). Disaster relief supply chain management also involves the

management of these flows, however, in disaster relief the source of raw materials becomes the donor and the end user becomes the beneficiary. Disaster relief supply chain management also involves preparedness, planning, procurement, transportation, warehousing, tracking and tracing, and customs clearance (Thomas & Kopczak, 2005). A disaster supply chain has been characterized as a set of well-executed and tightly coordinated tasks which include assessing victims' needs, fundraising, procurement, shipping, and distribution activities (Boin, Kelle, & Clay Whybark, 2010) as well as ''the processes and systems involved in mobilizing people, resources, skills and knowledge to help vulnerable people affected by disaster'' (Van Wassenhove, 2006).

Supply chain processes are defined as the set of tasks, steps, and procedures used to enact management of activities related to the supply chain, its flows, and its relationships. Specific processes include demand management, supply management, and fulfillment management. Demand management in the disaster environment is primarily concerned with needs assessment after a disaster strikes. Supply management is very complex in this environment – mixing the commercial practice of procurement from suppliers with the humanitarian practice of appeal to donors and matching donations to needs. Fulfillment management refers to how aid is delivered to the recipient from the point of procurement or donation to the most difficult "last mile". Flows related to these processes include information, financial, and materiel flows (Van Wassenhove, 2006; Kovács & Spens, 2007).

IMPROVISATION IN DISASTER RELIEF SUPPLY CHAIN MANAGEMENT

Improvisation has been studied in the management literature and in its essence is viewed as a path of creative departure from some original theme. Improvisation has been characterized as the balance of "making do" and "letting go" (Vera & Crossan, 2005), where the making do aspect refers to the creative process of trying to adapt to changing circumstances, and the letting go aspect involves the spontaneous nature of making decisions at a moment in time, or thinking on one's feet.

In defining improvisation, I intend to focus on the components of spontaneity and creativity for the purpose of this research. I adopt the definition used by Vera and Crossan (2004) which states improvisation is "…the spontaneous and creative process of attempting to achieve an objective in a new way."

Effective Improvisation depends on the concept that improvisation is not inherently good or bad. Improvisation has often times been characterized as an always good phenomenon, however, the use of improvisation may create either chaos or order and may contribute to a problem's solution or may contribute to the problem itself (Vera & Crossan, 2005). Effective improvisation, however, is defined as "the degree to which an action achieves instrumental outcomes of value for a firm" (Moorman & Miner, 1998).

Managing disaster relief supply chains is not just a matter of applying best practices from commercial supply chain management. It is evident both practically and theoretically, that improvisation plays a major role in disaster relief supply chain management and that effective disaster relief involves some mix of good planning and improvisation.

Disaster relief supply chain management is inherently a multi-disciplinary field. In one of the first theoretical research papers in disaster relief supply chain management, disaster relief supply chains are described as temporary supply chains set up for particular operations (Jahre, Jensen, & Listou, 2009). Following this line of thinking, we can see that the processes of disaster relief supply chain management can never be fully formalized, that the processes will always involve some element of newness, and thus will always require some level of improvisation. Further, leading improvisation research has stated that "If an event doesn't require improvisation, it probably is not a disaster" (Kendra & Wachtendorf, 2007), however the factors influencing the extent and quality of improvisation in disaster relief supply chain management processes have not been addressed. Having established that the nature of disaster relief supply chain management is temporary and changing and that performance will involve some combination of planning and improvisation, we should ask the following questions:

1. What organizational factors are the most influential on disaster relief supply chain performance?

2. What organizational factors are the most influential on the incidence and effectiveness of improvisation in disaster relief supply chains?

3. What measures best describe performance in disaster relief supply chains?

PERFORMANCE MEASUREMENT IN DISASTER RELIEF SUPPLY CHAIN MANAGEMENT

Disaster relief supply chain management, by its characteristics, may always involve some degree of improvisation. However, it is the overall performance of the disaster relief supply chain that matters in bringing relief to those in need and doing so in an effective manner. Improvisation has been linked to elements of performance, however, the incidence of improvisation as a neutral construct should not have a direct effect on performance, as evidenced in existing management research (Moorman & Miner, 1998; Vera & Crossan, 2005; Hmieleski & Corbett, 2008; Magni, Provera, & Prosperio, 2008; Kyriakopoulos, 2011).

Hypothesis 1: Incidence of improvisation will have no direct effect on disaster relief supply chain performance.

Theoretical and empirical work has shown that under certain moderating conditions, improvisation results in higher levels of innovation (Vera & Crossan, 2005; Magni et al., 2008), product and process effectiveness (Moorman & Miner, 1998), new venture performance (Hmieleski & Corbett, 2008), and cost efficiency, and market effectiveness (Kyriakopoulos, 2011). Although improvisation itself is neither good nor bad, the presence of context-specific moderating factors is shown to de-neutralize its relationship with performance. I argue that in disaster relief supply chain management, we must recognize that the role of improvisation in the supply chain function is ever present. Therefore, we must look to improve the performance of these supply chains not only through the more traditional role of planning, but also by searching

out factors which increase the effectiveness of improvisation in the context of disaster relief supply chain management.

Performance measurement research in disaster relief supply chain literature is scarce, even though performance measurement is recognized as a key to continually improving supply chain performance. Several researchers have introduced systems and specific measures for disaster relief supply chain performance measurement (Davidson, 2006; Beamon & Balcik, 2008; Van Der Laan, De Brito, & Vergunst, 2009). Van Der Laan et al (2009) develop a number of factors which must be present for both the organization and the measures themselves. These factors are argued to be the groundwork necessary for effective performance measurement. They suggest that an organization must recognize the strategic importance of supply chain management, be willing to measure operational performance, and lastly to have the proper information systems to collect the required data for performance measurement. They argue effective measures must be future oriented, strategically aligned, balance financial and non-financial factors, and balance the quantitative and qualitative aspects of performance. In a case study of Medicines sans frontiers – Holland, the authors look at performance measures being used and find that none of them completely satisfy the criteria identified in their research. Suggestions for improved metrics are given. Beamon & Balcik (2008) derive a disaster relief supply chain performance measurement framework from an earlier work in commercial supply chain performance measurement (Beamon, 1999). This adapted framework breaks performance measurement in to three factors which are resource performance, system output performance, and flexibility performance. Metrics for each category are introduced. Davidson (2006) develops a set of performance measurement metrics tailored to the International Federation of the Red Cross in which specific metrics are introduced that relate to measuring appeal coverage, donation-to-delivery time, financial efficiency, and assessment accuracy.

There are over 40 individual performance measures identified between these three studies, as well as others used in practice, and identified in case studies (Gatignon, Van Wassenhove, & Charles, 2010). In order to narrow these measures into a scale which reflects disaster relief supply chain performance, is of reasonable length for a questionnaire, and is likely to be most universal (as some of the measures were developed for specific organizations), the measures must be interpreted and integrated into categories. In more general terms, supply chain performance can be measured along different dimensions. Although disaster relief supply chain performance is an emerging field, and there are no universally accepted measures, the overall performance of the supply chain can be conceptualized along the dimensions of competitive priorities (speed, cost, flexibility, and quality). The most common priorities discussed in the disaster relief literature are speed and cost. The initial priority in a disaster relief effort is speed, which quickly shifts to cost efficiency as the relief effort matures, so these should be the most important performance factors in disaster relief supply chain management. Although the idea of competitive priorities stems from the commercial supply chain literature (Ward, McCreery, Ritzman, & Sharma, 1998; Krause, Pagell, & Curkovic, 2001; Boyer & Lewis, 2002) and is not explicitly addressed in the disaster relief supply chain literature, recent disaster relief research shows an implicit emergence of the factors. The disaster relief priorities of speed and cost, along with the shifting nature of these priorities' importance has been discussed in several prominent studies of disaster relief supply chain management (Van Wassenhove, 2006; Tomasini & Van Wassenhove, 2009; Whybark et al., 2010; Day, Melnyk, Larson, Davis, & Whybark, 2012; Van Wassenhove & Pedraza Martinez, 2012). Quality as a priority is evident in the need for quality

assessment of needs during the immediate aftermath of a disaster. This initial assessment has ripple effects that influence supply management, procurement, and fundraising activities throughout the relief effort. The importance of quality needs assessment is discussed in disaster relief performance measurement in terms of its effect on inventory obsolescence and initial needs assessment (Davidson, 2006; Beamon & Balcik, 2008). Lastly, flexibility is discussed in terms of responsiveness and agility in recent disaster relief reviews (Kovács & Spens, 2009; Ergun et al., 2010b) as well as being a direct factor in disaster relief performance measurement (Beamon & Balcik, 2008). The measures discussed, their categories, and meanings are summarized in Table 1.

Category	Formative Measures
Speed	Procurement delivery time Average response time Percent on-time deliveries
Cost	Inventory holding cost Number of relief workers employed per aid recipient Total cost of distribution
Quality (assessment)	Assessment accuracy Inventory obsolescence and spoilage Supply availability
Flexibility	Volume flexibility Delivery flexibility Mix flexibility New product flexibility

Table 1: Disaster Relief Performance Measures

FACTORS AFFECTING PERFORMANCE

A variety of academic strategies to improve disaster relief supply chain management performance have been introduced and seem to converge around several categories including pre-positioning of supplies and inventory management (Whybark, 2007; Kovács & Spens, 2009; Tomasini & Van Wassenhove, 2009; Balcik, Beamon, Krejci, Muramatsu, & Ramirez, 2010; Campbell & Jones, 2011), collaboration, networking, and communication (Long & Wood, 1995; Thomas & Fritz, 2006; Carroll & Neu, 2009; Kovács & Spens, 2009; Richey, 2009; Balcik et al., 2010), use of information technology (Zhang, Zhou, & Nunamaker, 2002; Tomasini & Van Wassenhove, 2003; Tomasini & Van Wassenhove, 2004; Kovács & Spens, 2007; Overstreet, Hall, Hanna, & Ranier, 2011), and training of logisticians (Thomas & Kopczak, 2005; Kovács & Spens, 2009). Although this is not an exhaustive list of strategies for improving disaster relief supply chain performance, each listed strategy comes from multiple sources and is generally agreed upon in the literature. In a similar attempt to converge upon factors influencing disaster relief supply chain performance, lists of critical success factors (CSF) have been introduced (Pettit & Beresford, 2009; Zhou, Huang, & Zhang, 2011). A critical success factor is defined as "the limited number of areas in which results, if they are satisfactory, will ensure successful competitive performance for the organisation" (Rockart, 1979). Many CSFs are similar to the categories listed above and these CSFs are derived from commercial supply chain research and

their applicability to disaster relief supply chains is discussed by Pettit & Beresford (2009). The combination of CSFs and other strategies found in the literature results in four areas which represent emergent themes in disaster relief supply chain management improvement strategy.

These categories are:

1. Strategic Planning Focus – A focus on long-term decisions and planning factors which affect the structure, size, management, and relationships of the supply chain. These decisions affect the entire supply chain and include structural decisions concerning outsourcing, supply chain design (e.g. lean or agile), collaboration, and human resource management.
2. Operational Planning Focus – A focus on operational decisions and planning factors which affect specific material flows and transportation utilization. These decisions affect only a portion of the supply chain. This category includes planning decisions concerning inventory pre-positioning, transportation mode, transportation constraints, port constraints, and material handling constraints.
3. Information Focus – A focus on knowledge management which includes lessons learned, performance data collection, and continuous improvement. The extent of information focus affects how information is collected and used in the planning cycle.
4. Technology Utilization – The extent to which systems are used to integrate supply chain activity. This includes connecting customers, suppliers, and other value adding activities.

A summary of the CSFs and categories can be found in Table 2.

Category	Factors
Strategic Planning Focus	**Strategic Planning** (= Strategic Planning + Supply Chain Strategy) (Thomas & Kopczak, 2005; Pettit & Beresford, 2009; Oloruntoba, 2010) **Human Resource Management** (Thomas & Kopczak, 2005; Pettit & Beresford, 2009) **Collaboration** (Thomas & Kopczak, 2005; Thomas & Fritz, 2006; Kovács & Spens, 2007; Carroll & Neu, 2009; Pettit & Beresford, 2009; Richey, 2009; Balcik et al., 2010; Ergun et al., 2010b)
Operational Planning Focus	**Inventory Management** (Whybark, 2007; Pettit & Beresford, 2009; Tomasini & Van Wassenhove, 2009; Balcik et al., 2010; Ergun et al., 2010b) **Transportation Planning** (= Transport Planning + Capacity Planning) (Pettit & Beresford, 2009)
Information Focus	**Knowledge Management** (= Information Management + Continuous Improvement) (Zhang et al., 2002; Thomas & Kopczak, 2005; Pettit & Beresford, 2009; Zhou et al., 2011)
Technology Utilization	**Technology Utilization** (Long & Wood, 1995; Zhang et al., 2002; Thomas & Kopczak, 2005; Kovács & Spens, 2007; Pettit & Beresford, 2009; Ergun et al., 2010b; Overstreet et al., 2011; Zhou et al., 2011)

Table 2: Critical Success Factors

Critical success factors, by definition, must have an effect on disaster relief supply chain performance. This effect has not been tested. In part due to the newness of the field, and in part due to the sparse research in disaster relief performance measurement. Due to the fact that these CSFs may influence many of the performance indicators discussed already, they should have a direct impact on the speed, efficiency, cost, and quality of assessment of the response. Although the implementation of planning does not negate the need for improvisation, these factors should decrease the incidence of improvisation due to the planned structure they lend to the relief effort.

H2: Higher levels of strategic focus will have a positive effect on disaster relief supply chain performance.

H3: Higher levels of operational focus will have a positive effect on disaster relief supply chain performance.

H4: Higher levels of information focus will have a positive effect on disaster relief supply chain performance.

H5: Higher levels of technology utilization will have a positive effect on disaster relief supply chain performance.

H6: Higher levels of strategic focus will have a negative effect on the incidence of improvisation.

H7: Higher levels of operational focus will have a negative effect on the incidence of improvisation.

H8: Higher levels of information focus will have a negative effect on the incidence of improvisation.

H9: Higher levels of technology utilization will have a negative effect on the incidence of improvisation.

From a capabilities perspective, other factors related to these critical success factors should influence incidence and effectiveness of improvisation. The definition of improvisation includes spontaneity and creativity, but effective improvisation also involves experience and knowledge. This experience and knowledge may be increased through the planning process, and also through intentional capability building by contributing to the experience and knowledge necessary to carry out an effective disaster response much like practice contributes to the experience and knowledge needed for effective musical and theatrical improvisation. In addition to building the capability to improvise in people, the technology infrastructure may contribute to the level of information sharing and communication needed to effectively improvise.

Capabilities-based factors can be expressed as creative capability, empowerment, and technology capability. Creative capability and enactment capability both influence a person's ability to act both creatively and spontaneously. Creative capability is defined as having the necessary

knowledge and experience to effectively devise new solutions to problems. This may be derived from a combination of training and experience. Training has been shown to influence the impact of improvisation on innovation, and expertise and teamwork skills (both similar to experience) have been shown to exert a similar effect on the impact of improvisation on innovation (Vera & Crossan, 2005). Empowerment means having the authority to implement a solution on the spot, and captures the spontaneous nature of improvisation. This capability to implement a solution stems from organizational culture and structure. This factor is similar to experimental culture, which has also been shown to have an effect on the relationship of improvisation to innovative performance (Vera & Crossan, 2005). Finally, technology capability is the adaptability, configurability, and deployability of the hardware used by an organization. Hardware that is usable in both pre and post disaster scenarios, and which is deployable to be used in the post-disaster response should increase the creative and spontaneous mechanism of improvisation by facilitating real-time information sharing and real time information flow, which have themselves been linked to improvisation's effect on performance (Moorman & Miner, 1998; Vera & Crossan, 2005). If these factors significantly influence improvisation and performance in disaster relief supply chains, the implications are validation of the relevance of improvisation to the disaster relief effort and identification of factors which represent organizational capabilities for good improvisation. If, in fact, a practitioner must choose which infrastructure elements of his or her organization to spend critical resources on, this will help the practitioner make a decision which has a greater effect on performance during relief operations.

H10: Higher levels of creative capability will have a positive effect on the incidence of improvisation.

H11: Higher levels of empowerment will have a positive effect on the incidence of improvisation.

H12: Higher levels of technology capability will have a positive effect on the incidence of improvisation.

Interaction/Moderating Effects:

H13: Creative capability will moderate the relationship between improvisation and disaster relief supply chain performance such that higher levels of Creative capability will increase the positive effect of improvisation on disaster relief supply chain performance.

H14: Empowerment will moderate the relationship between improvisation and disaster relief supply chain performance such that higher levels of Empowerment will increase the positive effect of improvisation on disaster relief supply chain performance.

H15: Technology capability will moderate the relationship between improvisation and disaster relief supply chain performance such that higher levels of Technology capability will increase the positive effect of improvisation on disaster relief supply chain performance.

THE MODEL

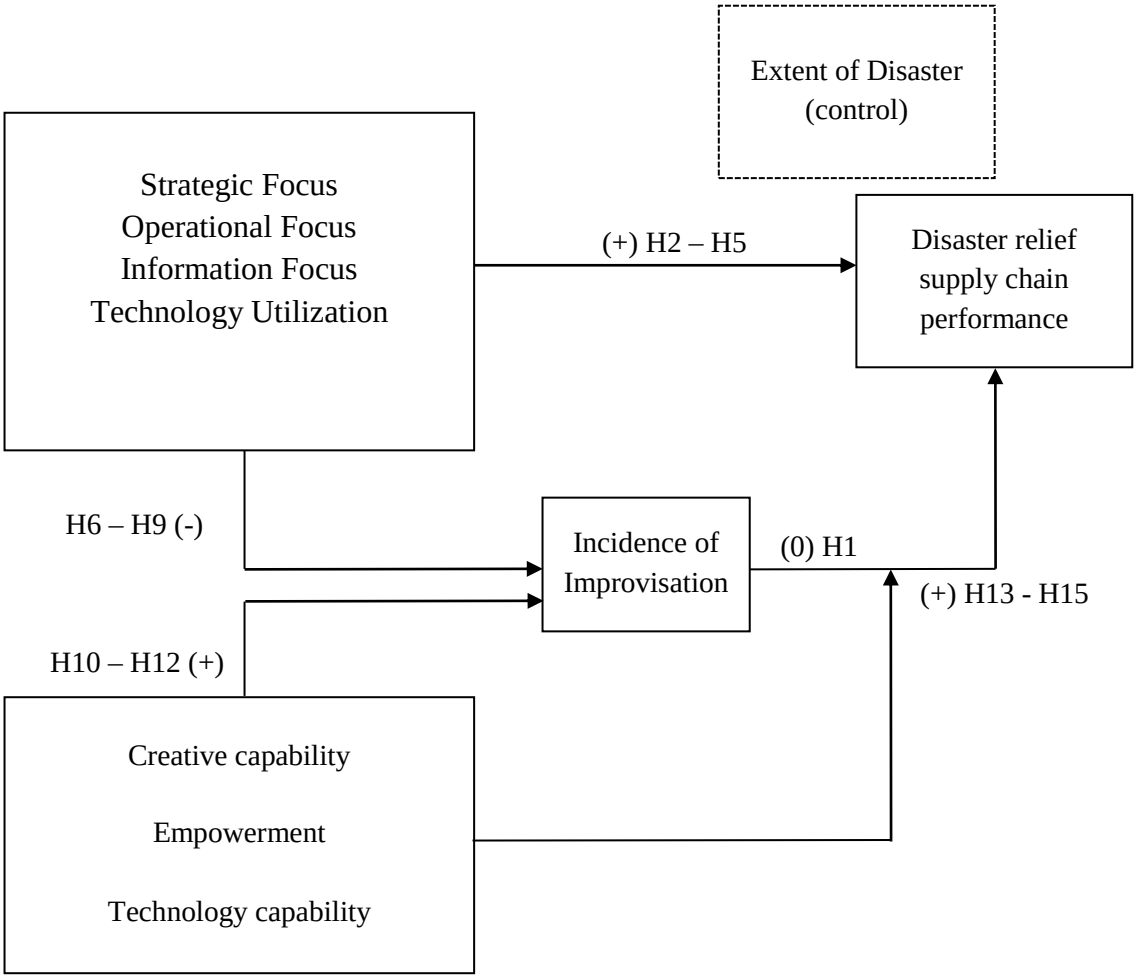

Figure 1: Research Model

As illustrated in Figure 1, The model assumes that the more one plans, the less one improvises, by the hypothesized negative relationship between factors associated with planning and incidence of improvisation. It also assumes capability factors lead to incidence and effectiveness of improvisation, so that either one is carrying out a planned or improvised action. The following questions will be answered by empirical analysis of this model. Which planning factors play the greatest role in disaster relief supply chain performance? Which capability factors play the greatest role in the incidence and effectiveness of improvisation? Whether or not the hypotheses are confirmed, the results will show how to increase performance by planning, creating improvisational capability, or a combination of the two. Practically, this means finding the right mix of planning activities, training, management, coordination, and using the right technology to enhance performance. In the end, this research is not about new technology, more advanced planning, or better management and coordination techniques (although the quality of these factors is important). It is about finding the right combination of what we already have available. It is about using the knowledge and resources available to achieve the best global results instead of focusing on sub-strategies to improve sub-aspects of overall performance in disaster relief.

EMPIRICAL STUDY

The study will examine the effects of strategic focus, operational focus, information focus, and technology utilization on the incidence of improvisation and disaster relief supply chain performance. These factors will be measured using a scale derived from the critical success factors listed above. The dependent variable, performance, will be measured using a scale derived from the performance measurement metrics identified above. The independent variable improvisation will be measured using a scale derived from definitions of improvisation and adapted from Vera and Crossan's (2005) scale and from questions derived specifically for this context. The impact of three moderators, creative capability, empowerment, and technology capability, will be assessed on the relationship between improvisation and performance using a scale derived for this research.

IMPACT OF STUDY

The interest in disaster relief supply chain management has grown rapidly in the past decade due to the occurrence of events which affect millions of people both domestically and internationally. Although the topic is widely expanding and receiving more research attention, there still remain the facts that (1) disaster relief supply chain management is an under researched and emerging topic, (2) humanitarian and/or not for profit (NFP) organizations seldom focus on supply chain management (SCM) improvements (Jahre et al., 2009; McLachlin, Larson, & Khan, 2009) because resources are tight, timing is unpredictable, and the cost of doing so may detract from fulfilling more immediate humanitarian needs, (3) approximately 80% of a disaster relief effort depends on logistics (Van Wassenhove, 2006), therefore (4) academic disaster relief supply chain management research and application of SCM best practices to disaster relief supply chain management will result in more effective and more efficient supply chains, at a relatively low cost to donor-dependent humanitarian and NFP organizations. The end result of these developments will be more timely and powerful aid to those in need. There is widespread consensus amongst disaster relief supply chain management scholars of this fact as well as that

academic disaster relief supply chain management research has much to contribute generally to practical disaster operations (Altay & Green, 2006; Van Wassenhove, 2006; Kovács & Spens, 2007; Jahre et al., 2009). Additionally, it is acknowledged that academic research in disaster relief supply chain management can fill the gap of improving processes and preparedness in-between disasters, where donor funding is lacking (Thomas & Fritz, 2006; Van Wassenhove, 2006).

This research views disaster recovery SCM through the paradigm in which complex networks form rapidly in turbulent environments, and are managed by a combination of planning and improvised processes. My focus here is on the planning and improvised processes and how to improve overall effectiveness, and thus improve the disaster relief supply chain performance outcome. Most current research and practice focuses on planning before the disaster occurs (Altay & Green, 2006; Overstreet et al., 2011), which leaves a gap for research which focuses on the combination of planning and improvisation. Although the research in commercial supply chain management contributes to successful businesses and enhances stakeholder's wealth, research in disaster relief supply chain management enhances mankind's ability to survive and recover from inevitable and sometimes uncontrollable events. As stated by McLachlin et al: "Humanitarian assistance supply chains must be flexible and responsive to unpredictable events. They must also be efficient, and able to operate within limited budgets. In such supply chains, more effective SCM (i.e. improved customer service) can be the difference between life and death; and greater efficiency means serving more people in dire need. While 'time is money' to the business logistician, time is life to the humanitarian" (McLachlin et al., 2009).

By gaining a better understanding of which factors improve the effectiveness of planning and improvisation on disaster relief SCM performance, more attention and (scarce) resources can be directed to enhancing the effectiveness of combined planning and improvisation, rather than a static focus on planning alone. This represents a contribution to the field of disaster relief SCM by improving our understanding of the use of processes which are the foundation of SCM. Most importantly this study fills a gap between research and practice in disaster relief supply chain management. Academics are in a prime position to supplement the scarce resources of the humanitarian community with research which will improve the not so glamorous supply chain processes in-between disasters, where donor funding is most times aimed at front-line, disaster-of-the-moment, operational needs (Thomas & Fritz, 2006; Van Wassenhove, 2006).

SCOPE AND LIMITATIONS OF STUDY

The research questions posed earlier can be answered most effectively by examining the operating practices of organizations which participate in disaster relief operations. The questions themselves seek to explore the specific relationships between several key variables, namely improvisation, strategic focus, operational focus, information focus, technology utilization, creative capability, empowerment, and technology capability; and how these variables are related to planning, improvisation, and disaster relief supply chain performance. The research study is framed in a disaster relief environment that includes organizations which undertake disaster relief operations. Such organizations may include not for profit humanitarian, government agencies, as well as for profit commercial enterprises. Although the outcome of this study should be most beneficial to organizations in the humanitarian sector, commercial supply chains

may also benefit and be included in the population being studied because commercial supply chains also engage in disaster relief operations (Rosengrant, 2007; Horowitz & Dana, 2008; Ergun, Heier Stamm, Keskinocak, & Swann, 2010a). Although their ultimate motives for doing so may be different from their humanitarian counterparts, the study of the organizational factors explored in this research will reveal the same relationships as it would in any other organizational setting.

This study recognizes that the research into improvisation and disaster relief supply chain management is a new and emerging field, and that it would be impossible to cover the nuances and complexities of the disaster environment in any single piece of research. This should be seen as a starting point from which more exploration into the relationships between organizational factors and improvisation in the realm of disaster relief SCM takes place. If the relationships presented in the model here hold true, future research needs to look at how much improvisation is taking place in a specific organization relative to planned action in the same organization – all within the context of a disaster relief scenario. Questions to be asked are: Is improvisation high compared to planned action? Is it low? Is there a point where planning actions cease to be useful, and what is that point for a specific organization? From these questions, specific organizations can answer the question of whether to focus efforts more on building improvisational capabilities or planning within the organization. This research serves as a starting point from which to explore the impact of organizational factors on planning and improvised process effectiveness and overall disaster relief supply chain performance.

REFERENCES

Altay, N., & Green, W. G., III (2006). OR/MS research in disaster operations management. *European Journal of Operational Research*, 175(1), 475-493.

Balcik, B., Beamon, B. M., Krejci, C. C., Muramatsu, K. M., & Ramirez, M. (2010). Coordination in humanitarian relief chains: Practices, challenges and opportunities. *International Journal of Production Economics*, 126(1), 22-34.

Beamon, B., M. , & Balcik, B. (2008). Performance measurement in humanitarian relief chains. *The International Journal of Public Sector Management*, 21(1), 4.

Beamon, B. M. (1999). Measuring supply chain performance. *International Journal of Operations & Production Management*, 19(3), 275.

Boin, A., Kelle, P., & Clay Whybark, D. (2010). Resilient supply chains for extreme situations: Outlining a new field of study. *International Journal of Production Economics*, 126(1), 1-6.

Boyer, K. K., & Lewis, M. W. (2002). Competitive Priorities: Investigating the Need for Trade-Offs in Operations Strategy. *Production and Operations Management*, 11(1), 9-20.

Campbell, A. M., & Jones, P. C. (2011). Prepositioning supplies in preparation for disasters. *European Journal of Operational Research*, 209(2), 156-165.

Carroll, A., & Neu, J. (2009). Volatility, unpredictability and asymmetry: An organising framework for humanitarian logistics operations? *Management Research News*, 32(11), 1024-1037.

CRED (2011) EM-DAT: The OFDA/CRED International Disaster Database – www.emdat.net – Université catholique de Louvain – Brussels – Belgium, accessed August 29, 2011, [available.

Davidson, A. L. (2006). *Key Performance Indicators in Humanitarian Logistics*, Massachusetts Institute of Technology, Cambridge, MA.

Day, J. M., Melnyk, S. A., Larson, P. D., Davis, E. W., & Whybark, D. C. (2012). Humanitarian and Disaster Relief Supply Chains: A Matter of Life and Death. *Journal of Supply Chain Management*, 48(2), 21-36.

Ergun, Ö., Heier Stamm, J. L., Keskinocak, P., & Swann, J. L. (2010a). Waffle House Restaurants hurricane response: A case study. *International Journal of Production Economics*, 126(1), 111-120.

Ergun, O., Karakus, G., Keskinocak, P., Swann, J., Villarreal, M., Cochran, J. J., Cox, L. A., Kharoufeh, J. P., & Smith, J. C. (2010b). Operations Research to Improve Disaster Supply Chain Management. *Wiley Encyclopedia of Operations Research and Management Science*: John Wiley & Sons, Inc.

Gatignon, A., Van Wassenhove, L. N., & Charles, A. (2010). The Yogyakarta earthquake: Humanitarian relief through IFRC's decentralized supply chain. *International Journal of Production Economics*, 126(1), 102-110.

Hmieleski, K. M., & Corbett, A. C. (2008). The contrasting interaction effects of improvisational behavior with entrepreneurial self-efficacy on new venture performance and entrepreneur work satisfaction. *Journal of Business Venturing*, 23(4), 482-496.

Horowitz, S., & Dana, C. A. (2008). Wal Mart to the Rescue: Private Enterprise's Response to Katrina. Canton, NY: St. Lawrence University.

Jahre, M., Jensen, L.-M., & Listou, T. (2009). Theory development in humanitarian logistics: a framework and three cases. *Management Research News*, 32(11), 1008 - 1023.

Kendra, J. M., & Wachtendorf, T. (2007). Improvisation, creativity, and the art of emergency management. In B. Durmaz, A. S. Sevinc, Yala, & S. Ekici (Eds.), *Understanding and Responding to Terrorism*: IOS Press, 324-335.

Kovács, G., & Spens, K. M. (2007). Humanitarian logistics in disaster relief operations. *International Journal of Physical Distribution & Logistics Management*, 37(2), 99.

Kovács, G., & Spens, K. M. (2009). Identifying challenges in humanitarian logistics. *International Journal of Physical Distribution & Logistics Management*, 39(6), 506.

Kovács, G., & Spens, K. M. (2011). Trends and developments in humanitarian logistics – a gap analysis. *International Journal of Physical Distribution & Logistics Management*, 41(1), 32 - 45.

Krause, D. R., Pagell, M., & Curkovic, S. (2001). Toward a measure of competitive priorities for purchasing. *Journal of Operations Management*, 19(4), 497-512.

Kyriakopoulos, K. (2011). Improvisation in Product Innovation: The Contingent Role of Market Information Sources and Memory Types. *Organization Studies*, 32(8), 1051-1078.

Long, D. C., & Wood, D. F. (1995). The logistics of famine relief. *Journal of Business Logistics*, 16(1), 213.

Magni, M., Provera, B., & Prosperio, L. (2008). Improvisation in geographically dispersed teams: does distance matter? , *IX Workshop dei Docenti e dei Ricercatori di Organizzazione Aziendale*. Venezia.

McLachlin, R., Larson, P. D., & Khan, S. (2009). Not-for-profit supply chains in interrupted environments: The case of a faith-based humanitarian relief organisation. *Management Research News*, 32(11), 1050 - 1064.

Moorman, C., & Miner, A. S. (1998). The Convergence of Planning and Execution: Improvisation in New Product Development. *The Journal of Marketing*, 62(3), 1-20.

myFoxAustin (2011). Unsolicited Goods May Overwhelm Recovery Efforts in Joplin. *myFoxAustin*. Austin, TX.

Oloruntoba, R. (2010). An analysis of the Cyclone Larry emergency relief chain: Some key success factors. *International Journal of Production Economics*, 126(1), 85-101.

Overstreet, R. E., Hall, D., Hanna, J. B., & Ranier, R. K. J. (2011). Research in humanitarian logistics. *Journal of Humanitarian Logistics and Supply Chain Management*, 1(2), 114-131.

Pettit, S., & Beresford, A. (2009). Critical success factors in the context of humanitarian aid supply chains. *International Journal of Physical Distribution & Logistics Management*, 39(6), 450.

Richey, J., R. Glenn (2009). The supply chain crisis and disaster pyramid: A theoretical framework for understanding preparedness and recovery. *International Journal of Physical Distribution & Logistics Management*, 39(7), 619-628.

Rockart, J. F. (1979). Chief executives define their own data needs. *Harvard Business Review*, 57(2), 81-93.

Rosengrant, S. (2007). Wal-Mart's Response to Hurricane Katrina: Striving for a Public-Private Partnership. *Kennedy School of Government Case Program*.

Thomas, A., & Fritz, L. (2006). Disaster Relief, Inc. *Harvard Business Review*, 84(11), 114-122.

Thomas, A. S., & Kopczak, L. R. (2005). From Logistics to Supply Chain Management: The path Forwards in the Humanitarian Sector. Fritz Institute.

Tomasini, R., M., & Van Wassenhove, L. N. (2004). Pan-American Health Organization's Humanitarian Supply Management System: De-Politicization of the Humanitarian Supply Chain by Creating Accountability. *Journal of Public Procurement*, 4(3), 437.

Tomasini, R. M., & Van Wassenhove, L. N. (2003). Coordinating Disaster Logistics after El Salvador's Earthquakes using SUMA's Humanitarian Supply Management System. *Fontainebleau Cedex, France: INSEAD*.

Tomasini, R. M., & Van Wassenhove, L. N. (2009). From preparedness to partnerships: case study research on humanitarian logistics. *International Transactions in Operational Research*, 16(5), 549-559.

Van Der Laan, E. A., De Brito, M. P., & Vergunst, D. A. (2009). Performance Measurement in Humanitarian Supply Chains. *International Journal of Risk Assessment and Management*, 13(1), 22-45.

Van Wassenhove, L. N. (2006). Humanitarian Aid Logistics: Supply Chain Management in High Gear. *The Journal of the Operational Research Society*, 57(5).

Van Wassenhove, L. N., & Pedraza Martinez, A. J. (2012). Using OR to adapt supply chain management best practices to humanitarian logistics. *International Transactions in Operational Research*, 19(1-2), 307-322.

Vera, D., & Crossan, M. (2004). Theatrical Improvisation: Lessons for Organizations. *Organization Studies*, 25(5), 727-749.

Vera, D., & Crossan, M. (2005). Improvisation and Innovative Performance in Teams. *Organization Science*, 16(3), 203-224.

Ward, P. T., McCreery, J. K., Ritzman, L. P., & Sharma, D. (1998). Competitive Priorities in Operations Management. *Decision Sciences*, 29(4), 1035-1046.

Whybark, C. D. (2007). Issues in managing disaster relief inventories. *International Journal of Production Economics*, 108(1-2), 228-235.

Whybark, C. D., Melnyk, S. A., Day, J., & Davis, E. (2010). Disaster Relief Supply Chain Management: New Realities, Management Challenges, Emerging Opportunities. *Decision Line*(May 2010).

WISH (2011). Unsolicited goods hinder Joplin recovery efforts. Indianapolis: WISH.

Zhang, D., Zhou, L., & Nunamaker, J. F. J. (2002). A Knowledge Management Framework for the Support of Decision Making in Humanitarian Assistance / Disaster Relief. *Knowledge and Information Systems*, 4, 370-385.

Zhou, Q., Huang, W., & Zhang, Y. (2011). Identifying critical success factors in emergency management using a fuzzy DEMATEL method. *Safety Science*, 49(2), 243-252.