FLORIDA INTERNATIONAL UNIVERSITY

Miami, Florida

FACTORS IMPACTING SUPPLY CHAIN PERFORMANCE DURING HUMANITARIAN ASSISTANCE/DISASTER RESPONSE OPERATIONS

A dissertation submitted in partial fulfillment of the

requirements for the degree of

DOCTOR OF BUSINESS ADMINISTRATION

by

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2021

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This dissertation, written by Walter I. Diaz, and entitled Factors Impacting Supply Chain Performance During Humanitarian Assistance/Disaster Response Operations, having been approved in respect to style and intellectual content, is referred to you for judgment.

We have read the dissertation and recommend that it be approved.

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Date of Defense: June 25, 2021

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DEDICATION

I dedicate this dissertation to my father, Ismael Diaz Ramirez, whose example of integrity, hard work, and steadfast dedication guides how I have lived my life; I know he is looking down upon me proudly at this educational accomplishment, and my mother Raquel, who at 91 years young, continues to steadfastly support me on all my endeavors. My parents emphasized the importance of education and gave me every possible tool to succeed in all of my life's undertakings. They laid an excellent foundation for me; however, on Friday, May 25, 1990, I met the love of my life; Alina, the best wife, mother, grandmother, and friend in the world. She has stood by me in the ups and downs of life; she is and always will be my soulmate – Te Quiero Mucho Amorcito! I undertook this endeavor, to demonstrate to my children that it is never too late to take on big challenges. Walter, Nicholas, my daughter-in-law Karine and my beloved granddaughter Sophie, you all bring so much joy, endless memories, and happiness to my life; take on and achieve great things-you will not succeed if you don't try.

ACKNOWLEDGMENTS

I wish to thank the members of my committee for their patience and unwavering support. The COVID-19 Pandemic made data collection and collaboration extremely challenging. Their direction and encouragement were most appreciated. Dr. Walfried Lassar was particularly helpful in guiding me during my research model development and quantitative methodology. Dr. Lassar's flexibility and willingness to discuss ideas was the lynchpin for my proposal, dissertation, and defense. Finally, I would like to thank my major professor, Dr. George Marakas. When he interviewed me during the admission process, he said, "I will change the way you think." I would like to acknowledge that this program has changed how I think and analyze the world I live in. All professors that were part of this program supported me and contributed towards my completion of this degree. Finally, the "Wolf Pack" members who have been with me through thick and thin in this process – our friendships will be everlasting.

ABSTRACT OF THE DISSERTATION

FACTORS IMPACTING SUPPLY CHAIN PERFORMANCE DURING HUMANITARIAN ASSISTANCE/DISASTER RESPONSE OPERATIONS

by

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This study explored the factors that affect supply chain performance during humanitarian assistance and disaster response operations. We examined the following theoretical coordination nodes, resource sharing, standardization of operations, joint logistics effort, and postponement on humanitarian supply chain performance. We collected survey data from 207 military and civilian logistics practitioners. Data were used to test a conceptual model, using linear regression with each direct effect relationship and moderating relationship tested. Results reveal the positive direct effect of standardization of operations and joint logistics effort on supply chain performance. However, standardization of operations' effect on supply chain performance is weakened by the moderating effect of resource redundancy. Results inform future military and civilian humanitarian assistance actors on the effects of studied coordination nodes on supply chain performance. We include implications and recommendations for further research.

Keywords: humanitarian assistance, disaster response, resource redundancy, postponement, joint logistics effort, supply chain performance, humanitarian supply chain

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ABBREVIATIONS AND ACRONYMS

APAN:	All Partners Access Network
AT:	Agency Theory
CMV:	Common Method Variance
CT:	Contingency Theory
HA/DR:	Humanitarian Assistance and Disaster Response
HSC:	Humanitarian Supply Chain
IO:	International Organization
NT:	Network Theory
NGO:	Non-Governmental Organization:
NSS:	National Security Strategy
PVO:	Private Volunteer Organization
RBV:	Resource-Based View
U.N.:	United Nations

I: INTRODUCTION

As I explored exciting topics for my dissertation, humanitarian supply chain management immediately came to mind. To reveal some of my background, I spent 22 years in the U.S. military and have served as the senior civilian healthcare administrator and medical logistician at U.S. Southern Command since 2005. In this capacity, I have overseen numerous humanitarian assistance operations—namely, response to the H1N1 Pandemic, the 2010 Haiti earthquake, the 2018 and 2019 deployment of the USNS COMFORT Hospital Ship in response to the Venezuelan migration crisis and others. The common challenge that crosses these types of disaster response operations is delivering humanitarian supplies in the wake of disasters. The U.S. National Security Strategy (NSS) is a public document that outlines the current national priorities, along with military and security posture. In the latest NSS (United States, 2017), the President outlined the following:

> The United States will continue to lead the world in humanitarian assistance. Even as we expect others to share responsibility, the United States will continue to catalyze international responses to man-made and natural disasters and provide our expertise and capabilities to those in need. We will support food security and health programs that save lives and address the root cause of hunger and disease. (p. 42)

The U.S. government's fiscal year (FY) concludes every September 30. The lead agency charged with responding to natural disasters is the U.S. Agency for International Development (USAID), which has an annual operating budget of over $41 billion for FY 21 (United States Agency for International Development, 2021). This commitment level cements the United States' commitment to supporting the greater good and saving lives. I aimed to empirically test my research question for implications and contributions

to the field and to answer the "so what" question. Additionally, the project is replicable, and statistical analysis is sound.

COVID-19: A Current Example of Disaster Relief

As I submitted this dissertation, life is dramatically changing. The world is a very different place than it was just 18 months ago. Travel from locations with a high COVID-19 incidence rate is restricted, businesses with large numbers of in-person interactions are closed, and the movement of supplies is limited. These events prove to be some of the most significant societal disruptions since WWII (Jola-Sanchez, 2020). The topic's relevance is unfolding in front of my eyes, and the importance of humanitarian supply chain performance will be crucial to ensure post-COVID-19 relief is provided promptly. The COVID-19 pandemic response in the United States does not bring the kinds of challenges that classic disaster response operations I have personally experienced brought, such as interrupted communication lines, blocked roads, and numerous left homeless. The Department of Defense deployed hospital ships, the USNS COMFORT and the USNS MERCY, to major ports in the United States to provide much-needed medical care to thousands of infected and non-infected COVID-19 patients. I remember one of my previous military commanders saying, “Unprecedented times lead to unprecedented actions.” The Department of Defense built these hospital ships to provide care to wounded U.S. military personnel involved in a major war – now they are saving lives right here in the United States. In addition to wreaking havoc on the U.S. economy, COVID-19 devastated Latin America and the Caribbean economies. The U.S. Southern Command provided N-95 masks, gowns, gloves, ventilators, and even field hospitals to some of the most affected countries. We worked with local

governments, private volunteer organizations (PVOs) and non-governmental organizations (NGOs) to support their COVID-19 efforts. Many countries in the region have had access to only Sinovac, a Chinese-manufactured COVID-19 vaccine, which, according to Chinese officials, is not highly efficacious against COVID-19 (BBC News, 2021). Therefore, U.S. Southern Command has recently highlighted to the U.S. Congress the need to donate U.S.-manufactured COVID-19 vaccines in Latin America and the Caribbean. Once again, U.S. Southern Command will be supporting an essential humanitarian operation—the distribution of U.S.-manufactured COVID-19 vaccines.

Research Focus

The aftermath of any disaster brings numerous actors, including national governments, regional governments, NGOs, international organizations, military forces, and other organizations that provide humanitarian assistance and disaster response (HA/DR) support. Given its organic logistics capabilities and the ability to mobilize quickly to an affected area, the military has increased its role in supporting HA/DR operations. I have personally witnessed this increasing role, which motivated me to identify and explore some of the factors that impact HA/DR supply chain performance. HA/DR actors have different foci, cultures, structures, mandates, and objectives to work together to coordinate their HA/DR efforts (Kovács & Spens 2007). The largest HA/DR operation undertaken in the western hemisphere was the 2010 Haiti earthquake. As an organization that has been called upon to respond to numerous relief efforts, the U.S. military was met with the same obstacle identified by other HA/DR actors, lack of coordination (Guha-Sapir et al., 2011).

Coordination: Definition and Challenges

Simatupang et al. (2002) defined coordination as "the act of properly combining several objects and processes to achieve the goals and objectives outlined for the supply chain" (p. 289). Other functions that need clarifying among HA/DR organizations are some of the United Nations' (U.N.) clusters outlined by Magshoudi et al. (2018). He stated that collaborative procurement, flexible transportation, civil-military coordination, information sharing, standardization, synchronization of resource flows, flexible supply base, supply chain visibility, and standardization are functions that need to be clearly defined. Guerrero-Garcia et al. (2016) described that during the 2015 earthquake in Nepal, HA/DR actors were unsuccessful in coordinating supply chain activities due to unsolicited donations, large numbers of HA/DR actors responding, oversaturation of media coverage, and competition for actors' resources.

During the 2010 Haiti earthquake, U.S. Southern Command dealt with many of the challenges mentioned above by identifying, segregating, and delivering many types of supplies that arrived at the Haiti International Airport. These challenges and other factors discussed led to delays in delivering critical supplies to the affected population (Guha-Sapir et al., 2011). The principal factors critical to a successful disaster relief chain are accuracy and delivery time. The most critical period in a disaster's wake is the first 72 hours. During this time, HA/DR actors perform needs assessments and activate the supply chain to deliver supplies. As previously identified, an HA/DR actor's speed is critical to disaster victims' survival. A delay in response or delivery time hampers the supply chain's delivery times and potentially interferes with non-relief items (Tomasini

& Van Wassenhove, 2009). In my experience, not sharing needs assessment information with other HA/DR actors may lead to inaccurate response delivery.

Factors that Impact Humanitarian Supply Chain Performance

The U.S. military has a burden not carried by other HA/DR actors; the lack of trust non-military organizations has towards military involvement. The U.S. military is working to overcome this burden by increasing openness and willingness to share information at the relief location (Guha-Sapir et al., 2011). Coordinating, sharing knowledge, and performing needs assessments are key elements that deliver relief supplies during HA/DR operations (Darcy & Hofmann, 2003). HA/DR actors' focus is on the expeditious nature of the response and the output of operations that will deliver resources on time and on budget to fulfill the affected population's requirements (Tomasini & Van Wassenhove, 2009). The large number of HA/DR actors involved in relief operations hampers coordination and communication and can lead to delayed delivery, increased costs, and unmet delivery goals set for the response phase (Jensen & Hertz, 2016). The situation above can duplicate efforts and create supply shortages (Balchick et al., 2010). In the wake of a disaster, too many or too few resources lead humanitarian organizations to act alone, not coordinate their actions, and exacerbate an already desperate situation (Scultz and Heigh 2009).

Supply Chain Performance Measurement

Beamon (1999) outlined a supply chain performance framework, which I used for this study. I examined the relationships that resource sharing, standardizations of operations, joint logistics effort, and postponement have on HA/DR supply chain performance by exploring the impact resource scarcity and resource redundancy have on

the relationships between the constructs (Maghsoudi, 2018). I undertook this study to inform U.S. military leadership and logistics enterprise on the aforementioned concepts' effects. A more significant role in HA/DR necessitates their participation in synchronizing the activities mentioned above.

Too often, HA/DR actors lack the necessary resources (material and human) or experience; therefore, they must be interdependent for logistics services, information, and available transportation (Van der Laan et al., 2009). Also, HA/DR actors' redundancy and scarcity of resources have led them to complement their respective resource streams (Day et al., 2012), impacting overall supply chain coordination and deteriorating supply chain performance. To relieve human suffering while responding to the 2010 Haiti earthquake, U.S. Southern Command collaborated and shared numerous types of supplies and commodities with other nations' responders (Guha-Sapir et al., 2011).

Summary of the Study and Research Question

To enhance the performance of the humanitarian supply chain for future U.S. military HA/DR operations, I examined the moderating effect of resource redundancy and resource scarcity (Maghsoudi, 2018) on the relationship between resource sharing, standardization of operations, joint logistics efforts, postponement, and the performance of U.S. military supply chain during disasters. I posited that the moderators mentioned above deteriorated supply chain performance. I sent and provided surveys to approximately 500 logisticians from the U.S. government, non-governmental organizations, private volunteer organizations, and international organizations that participated in disaster relief supply operations to investigate the relationships

mentioned above. I will continue by outlining the literature review, research model and hypotheses, methodology, results, limitations, and conclusions. The following is the research question: How do resource scarcity and resource redundancy impact the relationships between resource sharing, standardization of operations, joint logistics effort, postponement, and supply chain performance during humanitarian assistance and disaster response operations?

There are several practical and theoretical implications. The principal contribution of this study lies in proposing and testing a conceptual model that explores direct effects and the potential interaction (moderating effects) of resource redundancy and resource scarcity with a deterioration of a humanitarian supply chain's performance. Several managerial frameworks explain the conceptualization of the phenomena outlined in the research model, including agency theory, contingency theory, network theory, and resource-based view. I will outline research limitations and contributions in the final chapter of this paper.

I organized this paper into six chapters. This chapter provided a background, reasons for executing a humanitarian supply chain performance study, an overview of concepts, and potential managerial constructs' applicability. In chapter 2, I review the literature which contains the theory for the proposed humanitarian assistance supply chain performance research model. I will define the constructs and interactions among the constructs of interest, such as resource sharing, standardization of operations, joint logistics effort, postponement, resource redundancy, and resource scarcity. The conceptual model depicted at the beginning of chapter 3 was outlined by reviewing the relevant literature, which justifies various model components and research hypotheses.

Chapter 4 outlines the research methods used to examine the conceptual model, the research design, measurement and hypotheses development, sampling, and analysis procedures. Chapter 5 contains the model and hypothesis testing results. The dissertation ends with Chapter 6, in which conclusions are discussed, which are based on the results of hypothesis tests, implications, and suggestions for future studies.

II: LITERATURE REVIEW

In this chapter, I will first define some of the terms used throughout the study. I will outline the foundational concepts and constructs to establish a solid foundation for this research. The number and magnitude of disasters have increased exponentially (Insurance Information Institute, 2021). These disasters require enormous amounts of resources to be moved as quickly as possible to the affected population. In the wake of such disasters, logistics capabilities are crucial to supplying goods to an established supply chain.

Definitions and Concepts

To the military, logistics is "Planning and executing the movement and support of forces" (Joint Publication 4-0, 2019, p. GL-8). However, in many HA/DR operations, more than one of the U.S. Armed Forces will participate in relief operations defined as joint logistics. This concept of more than one of the U.S. Armed Forces emphasizes the need for coordination, highlighted as one of the lynchpins of logistics and supply chain management. Joint logistics is defined as "The coordinated use, synchronization, and sharing of two or more Military Departments' logistics resources to support the joint force" (Joint Publication 4-0, 2019, p. GL-8). Throughout this dissertation, I will use the terms "Sphere" or "Sphere Standards." The Sphere organization established standards for humanitarian operations used by most NGOs, including the Red Cross and Red Crescent movement (Sphere Standards, 2021).

It has been difficult for many HA/DR actors to nail down a definition of logistics. The following logistics definition will be used for this study "the process of planning, implementing and controlling the efficient, cost-effective flow of and storage

of goods and materials as well as related information, from the point of origin to the point of consumption to meet the end beneficiary's requirements" (Thomas & Mizushima, 2005, p. 60). U.S. military logisticians' role in HA/DR operations in the western hemisphere has been instrumental in saving lives, easing human suffering, and helping establish an enduring supply chain that other HA/DR actors can use when the U.S. military departs the disaster area. The ability to use military logisticians and engineers to reopen seaports, airports, and clear roadways has enabled other HA/DR actors to deliver much-needed supplies and medical care to affected populations. The military's training and experience in dealing with combat uncertainties make it ideal for dealing with an HA/DR operation (Weeks, 2007). Their ability to establish security and communications infrastructure, provide emergency medical care, and deliver relief supplies makes them well suited for HA/DR operations (Costa et al., 2017). As outlined in the U.S. National Security Strategy, the U.S. Armed Forces' primary mission is to deter aggression, and, if necessary, defeat an enemy that threatens national interests. However, the organic capabilities that make them well prepared for combat also make them ideal for HA/DR operations (Aversa, 2011).

Humanitarian Supply Chain

In the last decades, there has been an increase in the number of disasters, which resulted in the creation of the humanitarian supply chain (HSC) concept. In studying disasters, one determines that they have had and will continue to have an enormous impact on a country's society and economy (Balick et al., 2010). Balcick et al. 2010 states that HSCs primarily focus on managing large-scale risks since they can de-conflict the relationship between HA/DR relief actors. Also, they perform needs

assessments that look at the impact of disrupted supply chains, aim to optimize the relief efforts, and monitor ongoing relief efforts (Thomas, 2003). One of the challenges that I encountered when seeking to refine and define this research was that HSC and humanitarian logistics are used interchangeably in many studies (Ertem et al., 2010). In addition to defining the concept of logistics, it is essential to point out that while they focuses on the movement of personnel or materiel from the point of origination to the point of destination, the focus of supply chain management is on managing interactions throughout the enterprise to ensure the feasibility of the aforementioned movements (Cozzolino, 2012).

Humanitarian Logistics

Humanitarian logistics is defined by Thomas and Kopczak (2005) 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, to alleviate the suffering of vulnerable people" (p.12). Among the activities HSCs perform, they plan and support pre-disaster mitigation activities such as establishing local distribution points, constructing safe shelters, and constructing in-country warehouses. They also undertake planning activities such as deploying necessary personnel and required materiel to the relief location, and readying health and subsistence relief procedures to respond during the different phases once a disaster strikes (Kovács & Spens, 2007). I believe it is essential to point out the differences between commercial supply chains and HSCs. Commercial supply chains emphasize increasing stakeholders' value by focusing on strategies that increase efficiency and profitability. On the other hand, the focus of HSCs is to provide an expeditious response

and optimize operations that will use donations effectively, efficiently, and responsibly to respond to affected populations (Tomasini & Van Wassenhove, 2009). Donors trust HA/DR actors and expect accountability of the resources they provide to respond to disasters. Open communications with financial benefactors, which allows for audits and oversight, will be the linchpin to gain greater credibility and demonstrate effective use of resources (Maghsoudi et al., 2018).

While exploring the existing interdependence between elements of a supply chain, coordination emerged as a critical element to the integration of activities that support the achievement of supply chain goals as a whole, as well as those of its components (Simatupang et al., 2002). Coordination is critical because most HA/DR actors will focus on their core strengths and outsource their non-core activities; increasingly successful execution depends on actors' ability to coordinate their activities in the supply chain outside their boundaries (Soroor et al., 2009). Exploring the HA/DR literature, it was evident that improving coordination is a part of most authors' works. Many examples of HA/DR activities in Haiti and rebel-held Syria highlight coordination failures, which may have led to wasted resources and needless suffering (Heath, 2014). To improve coordination, new organizations are being established to fill the gap. Exploring disaster-ravaged nations, these countries have many existing coordination mechanisms. However, one of the principal coordination mechanisms is the United Nations' cluster system. It is a loose network that connects autonomous organizations in a United Nations-sponsored forum for HA/DR actors and can coordinate efforts. It may not be perfect, but frameworks such as the cluster system bring together civilian and military HA/DR actors (Heath, 2014). The Federal Emergency Management Agency

(FEMA) and Banamyong et al. (2019) defined a disaster's phases in the following manner: (a) phase one: mitigation – the phase in which actions are undertaken to preclude or decrease the reasons, effects, and aftermaths of disasters; (b) phase two: preparedness – the phase where planning, training, and educational activities are undertaken for events that cannot be mitigated; phase three: response – the phase that occurs in the immediate aftermath of a disaster and is where emergency relief supplies are distributed; and phase four: recovery – the phase where restoration efforts occur concurrently with the resumption of regular operations and activities. This study focused on phase three—the response phase—since this is the phase where the U.S. Southern Command has the most experience and can have the most impact in the wake of a disaster. In commercial and humanitarian supply chains, effective coordination among its components focuses on flexibility, innovation, and speed that provide a competitive advantage that enables them to thrive in the global arena (Lee, 2002).

Managerial Frameworks

Despite a large body of literature on the humanitarian supply chain, managerial constructs and theories to explain some of these complex phenomena have received less attention than other management fields (Gunasekaran et al., 2018). Of note, scholars such as Madhok (2002) have attempted to combine one or more managerial constructs to conduct theory-driven empirical studies (Dubey et al., 2021). This study used agency theory, contingency theory, network theory (NT), and resource-based view (RBV) to answer the research question and the relationships between the constructs used to create the hypotheses. Given the limited number of humanitarian supply chain studies that have

been conducted using managerial frameworks (Gunasekaran et al. 2018), this multi-theoretical approach should contribute to the humanitarian supply chain literature.

Agency theory applies to most relationship situations (Marjone, 2001). One party is called the principal, who delegates authority and decision-making control to their agent (Basu & Lederer, 2011). Agency theory's basic assumption is that agents, if left to their own devices, will exploit their principals and act in their own best interest unless monitored effectively (Miller & Whitford, 2007). In humanitarian supply chains, the principals (governments, private organizations, or PVOs) are distant. The agents, HA/DR actors, need to be provided incentives to do the right thing. Military actors are given budgetary, resource, and personnel limits that serve as controls for HA/DR operations. However, private entities and NGOs are responsible and accountable to their donors. They are provided incentives and direction regarding the amount of aid delivered to the disaster area. The other aspect of control exerted by the principal in the case of NGOs is their ability to be accredited to receive donations by the U.S. Department of State (United States Department of State, 2021). The principals, NGOs, and governments exert enormous pressure on their members to reject corruption and provide relief supplies to the affected population on time.

All HA/DR actors enter into contractual relationships with suppliers that will provide on-demand relief materiel in the wake of a disaster. This relationship is where the classic principal-agent relationship enters humanitarian assistance and disaster response (Ross, 1973). Mitnick (2013) posited that entering into contracts or any legal agreements has the essential elements of agency theory. Most commercial relationships can be seen as an agency relationship (Bergen et al., 1992). The higher the alignment between the

principal and the agent, the higher the probability that the agent will work in the principal's interest (Cuevas-Rodríguez et al., 2012). In HA/DR operations, existing long-term contracts between HA/DR actors and their suppliers should help prevent unexpected cost increases and maintain information symmetry between the principal and agent. This can enable governments, NGOs, PVOs, and other HA/DR actors to deliver relief supplies without the need for expending their limited resources on last-minute expedited purchases – as long as the agent (supplier) complies with the contractual obligations. When the principal and agent goals are not aligned, information asymmetry leads to the so-called agency problem. Different goals and information asymmetry can impact supply chain performance.

When exploring contingency theory, I found that uncertainty is its central concept (Downey & Slocum, 1975). It specifies that the performance of an organization depends on the fit between its structure, processes, and environment (Lawrence & Lorsch, 1967). Contingency theory's domain has elements relevant to achieving goals while dealing with customers or stakeholders, suppliers, competitors, and government entities. Its environment contains relevant elements to goal attainment, including customers, suppliers, competitors, and regulatory agencies. I also found that several factors affect a firm's ability to manage supply risks proactively. This is aligned with contingency theory, which suggests that an optimal course of action depends on an organization's internal and external situation (Fiedler 1964; Lawrence & Lorsch 1967; Luthans et al., 1976). Contingency theorists posit that decisions regarding the best way ahead are contingent on environmental factors that affect an organization's internal and external conditions (Stonebreaker & Afifi, 2004).

Previously, efforts to apply NT to the supply chain have focused on a bilateral exchange between two network members (Halldorsson et al., 2007). However, a supply chain can be explored as a network by depicting it as a system on nodes representing independent entities that can make their own choices (Shafiq & Soratana, 2019). Connections between these entities represent relationships and any underlying commitment, if present. Exploring these relationships, one should consider numerous connections; however, in HA/DR supply chains, the study's focus is on materiel flows, human resources flows, and informational flows. Materiel flows refer to relief supplies to and through the supply chain, which provide relief to the affected population. Human resources flows refer to the labor required to operate the HA/DR supply to receive, sort, and distribute relief to the affected population. Informational flows are significant in an HA/DR supply chain since they are the lynchpin for all coordination activities. Finally, despite governments' and NGOs' involvement in HA/DR operations, financial resources are essential; every organization has limited financial resources and must ensure efficient use. This unique network, HA/DR supply chain, exists to deliver supplies to affected populations (Shafiq & Soratana, 2019).

RBV is an approach to optimizing an organization's performance (Barney, 1991). RBV scholars posit that organizations should look inside the company to find the sources of competitive advantage instead of looking outside the organization. According to RBV scholars, it is much more feasible to exploit external opportunities using existing resources in a new way rather than acquire new skills for each option. In RBV, resources are given a significant role in helping companies to achieve higher organizational performance. There are two types of resources: tangible and intangible. Tangible

assets are physical things such as buildings, equipment, and capital. Intangible assets are everything else that has no physical presence but can still be owned by the organization, such as intellectual property, standard operating procedures, etc. Valuable, rare, imperfectly imitable, and not substitutable resources, when shared, will have a positive effect on supply chain performance.

Constructs

Resource sharing is considered critical to HA/DR operations' success due to the ability to share assets among and between NGOs, private volunteer organizations (PVOs), local entities, and other organizations throughout the disaster area (Carter 2008; Tomasini & Van Wassenhove, 2009). Sharing supply chain-related information within the United Nations' cluster system will reduce coordination costs during the disaster relief phase (Balcik et al., 2010). For the reasons mentioned above, resource sharing will always be an essential element for the HA/DR enterprise's success since it can enhance responsiveness and reduce operational costs. The sharing of resources amongst and between HA/DR actors can affect an HA/DR supply chain's performance (Beamon, 1999). RBV outlines that supply delivery draws from resources that are valuable, rare imitable, and not substitutable. These resources include tangible and intangible assets (Barney et al., 2011). Resources can be: human resources, technological resources, infrastructure, subject matter expertise, and other means that enhance coordination (Größler & Grübner, 2006). The bundling of different resources helps improve a supply chain's performance (Newbert, 2007). Bundling is defined as integrating resources that allow exploiting opportunities while mitigating threats (Grant, 1991). Finally, RBV

scholars posit that performance results are a consequence of resources and capabilities that can be important factors for delivering goods (Kamasak, 2017).

The second coordination node discussed is standardization of operations which can improve the performance of HA/DR supply chains (Kovács & Spens, 2011). When looking at some coordination obstacles, standardization can be of great value to sorting numerous sources and types of information and to help avoid information overload. Following or establishing standards can enhance interoperability and seamless information sharing (Bui et al., 2000). However, unstandardized procedures and processes will significantly contribute to the failure of an HA/DR operation. One example of such lack of standards was the case of an HA/DR operation in Ghana. Their National Disaster Management Organization did not enforce Sphere Project or other standards used by international relief organizations. Ghana's lack of standardization enforcement resulted in poor supply chain outcomes (Kovács & Spens, 2009). NGOs used non-standardized forms of information and communication at other locations as part of the needs assessment process. Lack of standardization can cause disruptions and a ripple effect in the supply chain, impacting its performance heavily (Ivanov et al., 2014, 2017). The disruptions mentioned above form a part of most relief operations. Network theory explains a supply chain as a system of relationships among various entities, including, for instance, customers, suppliers, or manufacturers (Coviello & Munro, 1995). Disruptions can alter supply chain responsiveness and significantly affect supply chain performance (Ivanov et al., 2017).

An effective and efficient supply chain needs to be synchronized to optimize coordination. As such, it should have aligned the processes undertaken for the

purchasing of products and services in a rapidly changing HA/DR environment (Simatupang et al., 2002). Specifically, joint logistics effort and postponement aim to match items delivered with the affected population's requirements (Fisher 1997). Proper recognition of beneficiaries' requirements, coupled with a thorough understanding of all logistics activities among HA/DR actors, will reap benefits. Among such advantages, there is an expedited response, improved supply availability, reduced inventory costs, and reduced variation of anticipated events, negatively impacting supply chain outcomes (Lambert et al., 1998). Also, joint logistics effort and postponement support HA/DR actors' ability to resolve any conflicting roles or responsibilities, so each organization can perform a specific activity and improve supply chain efficiency (Simatupang et al., 2002). The main effort consists of focusing on the principal activities that provide relief to the affected population (Simatupang et al., 2002). Joint logistics process is conceptualized as combined or collaborative efforts, such as combined or collaborative forecasting, combined or collective inventory, replenishment management, combined or collaborative warehousing, and assortment planning (Simchi-Levi et al., 2007). With postponement, one delays materiel delivery until the latest possible moment that orders are received (Van Hoek, 2001). As outlined earlier, RBV scholars posit that performance results are a consequence of resources and capabilities that can be essential factors for delivering goods (Kamasak, 2017), explaining joint logistics effort and postponement of the supply chain.

Lack of resources or resource scarcity creates a difficult barrier to overcome as it is challenging to coordinate with other organizations when there are limited resources. At times, limited relief supplies force HA/DR actors to contend for what little resources

are available; these actions may hamper any coordination efforts undertaken in future HA/DR operations. In addition to resource scarcity, resource redundancy affects the relationship between coordination nodes and supply chain performance (e.g., Balcik et al., 2010). As resources are scarce or redundant, they become contingency factors caused by the uncertainty of the HA/DR environment (Kunz & Gold, 2017). These coordination nodes were selected due to their applicability to any HA/DR actor's supply chain. The U.S. military is not exempt from the challenges facing other HA/DR actors engaged in disaster relief. This study will empirically demonstrate to military leaders what factors impact their supply chain in the wake of disasters and will recommend avenues of cooperation, synchronization, and de-confliction with non-U.S. military entities. The U.S. military, along with many other HA/DR actors, initiates participation in HA/DR operations by attempting to act independently and generally not sharing resources or information. U.S. Southern Command has sponsored the All Partners Network (APAN) information-sharing platform that HA/DR actors can use during a disaster. However, adoption by non-government entities has been slow. At the time of this writing, the HA/DR community has yet to establish a broadly used set of standards to measure the affected population's needs and to measure the effectiveness of assistance before or after an HA/DR event (Abdelmagid et al., 2019; Maghsoudi et al., 2018). In addition, there are non-existent standards that establish sharing rules and procedures within and among organizations. Other aspects, such as information and training, have been standardized in HA/DR supply chains (Abdelmagid et al., 2019; Maghsoudi et al., 2018). Balcik et al. (2010) posited that the relief area's chaotic environment can have a negative effect on coordination efforts, which can result in

degraded supply chain performance. Besiou et al. (2011) stated that HA/DR operational environment is replete with constrained resources and unrealistically short deadlines. Balcik et al. (2010) identified the lack of resources (e.g., technological, informational, financial, and human) as a barrier during the disaster response phase, creating coordination difficulties. Also, Ergun et al. (2010) argued that HA/DR actors are often required to operate in areas where resources were limited before the disaster, making reception and delivery of supplies unpredictable. Schulz and Blecken (2010) posited that coordination between HA/DR helps increase the overall operations' impact, while a lack of coordination wastes resources.

Beamon (1999) outlined a supply chain performance measurement construct, which was used for this study. In her study, Beamon explored supply chain measurements and sought to provide a standard manner in which to measure supply chain performance. Beamon stated that cost was the primary supply chain performance measure at the time. However, to provide a complete definition, one must use more than one performance measure since one step can ignore critical organizational strategic goals. For this study, resource measures, output measures, flexibility measures, and supply chain performance perceptions were used to measure the humanitarian supply chain's performance. Despite it being a little-mentioned factor in a humanitarian supply chain, cost can drive the selection of different transportation conveyances to provide HA/DR supplies for a more extended period. Even in a U.S. government entity, cost matters.

Resource measures such as efficient use of personnel and minimizing costs are essential; therefore, it was one of my humanitarian supply chain performance measures. I linked each of its three independent measures of supply chain performance with well-

known measures used in the supply chain literature. Resource measures principally consider operational costs, personnel costs, and costs of placing orders. However, supply chain efficiency has been identified as a critical driver of supply chain performance in the supply chain literature. It requires efficient relationships with external supply chain stakeholders (Lee, 2000). Using reliability, cost, and on-time delivery and their impact on delivering supplies to the affected population, one can measure efficiency. For example, if an HA/DR actor possesses reliability and speed at a low or predetermined cost, it can be considered efficient. It is also essential that supply chains do not remain static and continuously improve and change to meet the needs of stakeholders and affected populations (Little, 1999). By linking resource measures and efficiency, both terms will be used interchangeably when referring to the research model or supply chain performance dimensions.

Output measures are at the heart of a humanitarian supply chain; they include the all-important on-time delivery and responsiveness. In the wake of a disaster, it is critically important that affected populations receive the necessary relief at the right time. The first 72 hours following a natural disaster are essential to saving lives and relieving suffering (Beamon, 1999). In the supply chain literature, this phenomenon is known as supply chain effectiveness. Talley (1994) outlined a definition of effectiveness by referring to the output of the supply chain and whether it delivers goods to the affected population, without regard for the amount of financial or human resources consumed to deliver them. According to Bridgefield Group (2006), effectiveness refers to overall measurement founded on an output quantity generated by a given input quantity. Humanitarian supply chains must deliver goods as soon as possible to save lives and

mitigate human suffering, so effectiveness is key to their mission. By linking output measures and effectiveness, both terms are used interchangeably when referring to the research model or supply chain performance dimensions.

Flexibility measures are vital in the humanitarian supply chain. The sheer unpredictability of demand location, quantity required, and ability to quickly shift volume levels make flexibility measures key to saving lives and reducing human suffering (Beamon, 1999). In the humanitarian supply chain literature, this phenomenon is referred to as supply chain agility. As more and more humanitarian supply chain studies have been conducted, supply chain agility has gained popularity among scholars who study nonprofit supply chains (Oloruntoba & Gray, 2006). Indeed, Dubey and Gunasekaran (2016) posited that agility in humanitarian supply chains is a required quality that enhances organizations' ability to excel in completely uncertain environments (Oloruntoba & Kovács, 2015). These scholars also emphasize that an agile humanitarian supply chain is vital for enhancing supply chain performance. By linking flexibility measures and agility, both terms are used interchangeably when referring to my research model or supply chain performance dimensions.

The final performance measure used for this research was supply chain performance perceptions. Stakeholders' perceptions of supply chain performance can have an enormous influence on performance. Ideas regarding timely arrival of supplies, delivering supplies within an assigned budget, and providing a consistent flow of relief supplies can help strengthen or weaken supply chain performance and influence supply chain optimization (Pushpamali, 2021). Measuring supply chain performance perceptions will provide advice to military leaders regarding any processes or procedures perceived

as not meeting established standards (Saruchera, 2021). Leadership can then take action and, if necessary, modify existing processes to improve supply chain performance. As previously defined, a supply chain is composed of organizations that work together to deliver goods. However, those organizations have transactional relationships with each other. Therefore, agency theory is the theoretical foundation for supply chain performance. Despite the urgency and emergency nature of HA/DR, every government, NGO, and PVO has limited resources. For humanitarian supplies to be delivered efficiently, resources (human, information, and materiel) must be appropriately managed (Lim & Mohamed, 1999).

Now that the constructs have been defined, the unit of analysis, the military logistician, will be described. Military logisticians are responsible for ensuring that equipment and people are where they need to be exactly when they need to be there. They are also accountable for precise planning and organization and must consider all possible aspects, phases, and contingencies while working in conjunction with other organizations to ensure every mission is safe, successful, and goes according to plan (Today's Military, n.d.). I will now discuss the research model and hypothesis operationalized to conduct this research.

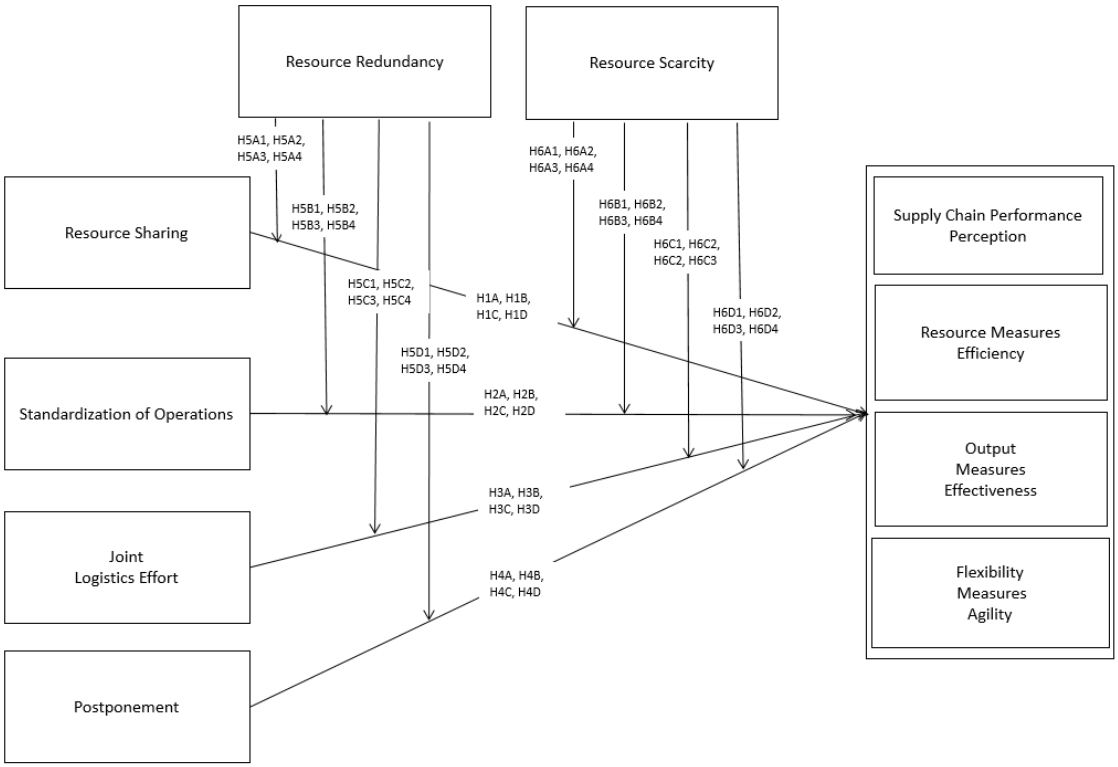
III: RESEARCH MODEL AND HYPOTHESES DEVELOPMENT

Hypotheses Development

I examined the relationships between constructs in the conceptual model depicted in Figure 1. I discussed the impact of coordination on sharing ad-hoc and existing infrastructure as a critical issue while conducting HA/DR operations (Carter, 2008). Sharing non-government resources fosters coordination of efforts between HA/DR actors who participate in humanitarian relief clusters (Carter & Rogers, 2008). Among HA/DR actors, including NGOs, governmental organizations, the private sector, and military forces, information sharing has been low. Information includes details regarding warehousing, transportation conveyances, and communication tools.

Figure 1

Conceptual Model



Resource sharing is critical among HA/DR actors and local government entities and organizations contributing to saving lives and relieving human suffering (Carter & Rogers, 2008; Tomasini & Van Wassenhove, 2009). Without sharing relevant information within the U.N. cluster and using all available communication systems, technology, and coordination, costs will increase during relief operations (Balcik et al., 2010). Resource sharing is key to successful coordination among HA/DR donors and suppliers and other local organizations during a disaster. Resource sharing reduces operational costs, which improves the supply chain's responsiveness. However, the information received from local governments and local NGOs is often ignored or unnoticed by HA/DR actors. They often ignore local information despite local

organizations' first-hand knowledge of the situation and the potential role this information plays in terms of resource sharing (Scheper et al., 2006). Sharing relevant data among HA/DR actors leads to shorter delivery times and information technology alignment during the delivery of supplies to affected populations (Balcik et al., 2010). Using RBV, one can see that valuable, rare, imperfectly imitable, and not substitutable resources, when shared, will have a positive effect on the four dimensions of supply chain performance. Therefore, the following hypotheses are proffered:

H1a: If resource sharing increases, the supply chain performance perception will increase during humanitarian assistance and disaster response operations.

H1b: If resource sharing increases, the supply chain performance efficiency will increase during humanitarian assistance and disaster response operations.

H1c: If resource sharing increases, the supply chain performance effectiveness will increase during humanitarian assistance and disaster response operations.

H1d: If resource sharing increases, the supply chain performance agility will increase during humanitarian assistance and disaster response operations.

Among HA/DR actors, standardization of operations involves various categories such as information, warehousing, storing, transportation, delivery, developing uniform labeling for relief supplies (Ergun et al., 2010), or standardized training (Aguilar & Retamal, 2009). As a long-term participant in HA/DR operations, I would like to point out that there is no common standard that measures humanitarian

needs and evaluates the long-term effectiveness of assistance before or during disasters. Following the 2010 Haiti earthquake, the U.S. Southern Command's most challenging decision was when U.S. military personnel would depart Haiti to allow local authorities and international NGOs to control the humanitarian supply chain. U.S. Southern Command ensured there was enough standardization among and throughout HA/DR actors before departing from Haiti (Guha-Sapir et al., 2011). As was the case during the Haiti earthquake, HA/DR actors use several forms of non-standard information exchanges during their needs assessment. Establishing standard, widely used information technology (IT) systems may simplify and ease information sharing between HA/DR actors and reduce errors throughout partnership and interaction with other HA/DR actors (Bowersox et al., 1999). Common guidelines for joint use and information-sharing protocols are also non-existent among and within HA/DR actors. Relief needs reports are frequently communicated in narrative style from the affected areas, complicating the extraction and dissemination of critical information. HA/DR actors have made many efforts to standardize materiel in HA/DR operations. One example is the Sphere standards, an agreement among HA/DR actors to use a minimum set of standards for relief materiel (Zutphen & Damerell, 2011). The implementation and use of Sphere standards have reduced both the time required and cost of HA/DR operations (Weerawat, 2007). Standardization of relief materiel—e.g., standardized catalogs—has facilitated the correct dissemination of relief orders while enhancing HA/DR actors' ability to measure reliability, responsiveness, and efficiency within and among HA/DR actors. Organizations can standardize materiel by implementing a barcoding system coupled with a database of standard HA/DR relief

materiel (Balcik et al., 2010). This system provides logisticians a better idea regarding the size and weight of humanitarian relief supplies to adequately plan their integration into the humanitarian supply chain to deliver them to affected personnel. The actions mentioned above can improve standardization during HA/DR operations (Van Wassenhove & Pedraza Martinez, 2010). Using NT, we can theorize that when resources are standardized and move along the supply chain, they have a positive effect on the four dimensions of supply chain performance. Therefore, the following hypotheses are proffered:

H2a: If standardization of operations increases, then supply chain performance perception will increase during humanitarian assistance and disaster response operations.

H2b: If standardization of operations increases, then supply chain performance efficiency will increase during humanitarian assistance and disaster response operations.

H2c: If standardization of operations increases, then supply chain performance effectiveness will increase during humanitarian assistance and disaster response operations.

H2d: If standardization of operations increases, then supply chain performance agility will increase during humanitarian assistance and disaster response operations.

Joint logistics effort and postponement are crucial elements to ensuring the on-time delivery of relief materiel and services at every critical step within the HA/DR supply chain (McEntire, 2002). HA/DR actors can reduce preparation time by having a clear understanding of logistics activities and then the ability to coordinate multiple,

simultaneous actions with an ongoing disaster. However, other researchers point to the significance of postponement (Jahre & Heigh, 2008; Scholten et al., 2010). Supply chain components, such as purchasing, storing, moving, and distributing, can generally be fragmented. Whether NGOs, governmental, or military, each organization manages its respective logistics systems within the HA/DR supply chain (Oloruntoba & Gray, 2006). Given these fragmented circumstances, synchronizing those efforts might help organizations to use scarce resources efficiently. Joint logistics process is joint-logistics efforts, such as assortment planning, joint forecasting, joint inventory, and replenishment management (Simchi-Levi et al., 2007). Joint logistics efforts enable HA/DR actors to synchronize the HA/DR supply chain. Postponement refers to delaying product delivery to the latest possible time until users' orders are received (Van Hoek, 2001). Since there are scarce material resources, humanitarian organizations can also postpone the human capital resources by establishing rosters of on-call staff that can rapidly support large HA/DR operations (Kovács & Spens, 2009). HA/DR actors can pool relief supplies until they determine which types need to be provided and delivered to the affected population. This delay is made possible by using smaller local NGOs specializing in different relief supplies (Kovács & Spens, 2009). Saving and allocating financial resources that can be used for expedited HA/DR operations, postponing delivery, and pooling resources are intangible preparedness activities (Tomasini & Van Wassenhove, 2009). Postponement is an activity that can save the financial resources that would be required for materiel prepositioning, and it enables the relief supplies assignment to be as rapid as appropriate. Using RBV, one can see that valuable, rare, imperfectly imitable, and not substitutable resources increase

joint logistics efforts and postponement and have a positive effect on the four dimensions of supply chain performance. The higher the level of joint logistics efforts and postponement, the higher the level of performance obtained. The following hypotheses are proffered:

H3a: If joint logistics efforts increase, then supply chain performance perception will increase during humanitarian assistance and disaster response operations.

H3b: If joint logistics efforts increase, then supply chain performance efficiency will increase during humanitarian assistance and disaster response operations.

H3c: If joint logistics efforts increase, then supply chain performance effectiveness will increase during humanitarian assistance and disaster response operations.

H3d: If joint logistics efforts increase, then supply chain performance agility will increase during humanitarian assistance and disaster response operations.

H4a: If postponement increases, then supply chain performance perception will increase during humanitarian assistance and disaster response operations.

H4b: If postponement increases, then supply chain performance efficiency will increase during humanitarian assistance and disaster response operations.

H4c: If postponement increases, then supply chain performance effectiveness will increase during humanitarian assistance and disaster response operations.

H4d: If postponement increases, then supply chain performance agility will increase during humanitarian assistance and disaster response operations.

Balcik et al. (2010) posited that the relief environment's characteristics can have a considerable effect on humanitarian organizations' coordination effort, which leads to

poor performance. Besiou et al. (2011) pointed out that the HA/DR operational environment is full of time pressures, short deadlines, and on most occasions, limited resources. Balcik et al. (2010) posited that limited informational, financial, and human resources hamper the preparation and response phases of HA/DR operations and can limit coordination opportunities. Ergun et al. (2010) argued that HA/DR supply chains often operate in areas with limited resources, resulting in wildly variable HA/DR supply chain outputs. Schulz and Blecken (2010) stated that coordination between HA/DR actors enhances HA/DR supply chain performance, while failing to coordinate wastes HA/DR human and materiel resources. Despite its benefits, coordination between organizations is complex due to various barriers, such as limited to scarce resources at the relief location.

Balcik et al. (2010) developed a mechanism to coordinate efforts to improve HA/DR supply chain performance by identifying the standardization of processes as an essential HA/DR supply chain element. However, the HA/DR location's environment and characteristics will have an effect on the relationship between standardization and performance. There are locations where limited resources force HA/DR actors to compete for limited resources, proving harmful to future coordination efforts.

Against this backdrop, managerial constructs are used to explain moderation relationships. Earlier it was posited that resource sharing had a positive direct effect on supply chain performance. It was further theorized resource redundancy could deteriorate the relationship between resource sharing and supply chain performance. Too many resources can lead to inefficiencies by "clogging up" the supply chain. In the HA/DR supply chain, too many logisticians of the same specialty—e.g., too many transportation

specialists, too many warehouse specialists, too many supply specialists—can slow down the supply chain. Their lack of expertise when delivering and distributing relief supplies creates inefficiencies (Joint Publication 4-0, 2019). In addition, too many redundant administrative requirements and too many redundant or duplicate supplies can negatively affect the four dimensions of supply chain performance (Maghsoudi, 2018) and inhibit efficiency (Michelman, 2007). As outlined earlier in the managerial construct discussion, NT explains the following hypotheses:

H5ai: Resource redundancy deteriorates the positive relationship between resource sharing and supply chain performance perception during humanitarian assistance and disaster response operations.

H5aii: Resource redundancy deteriorates the positive relationship between resource sharing and supply chain performance efficiency during humanitarian assistance and disaster response operations.

H5aiii: Resource redundancy deteriorates the positive relationship between resource sharing and supply chain performance effectiveness during humanitarian assistance and disaster response operations.

H5aiv: Resource redundancy deteriorates the positive relationship between resource sharing and supply chain performance agility during humanitarian assistance and disaster response operations.

As defined earlier, contingency theorists state that many decisions regarding selecting a course of action depend on internal and external environmental conditions that impact the organization (Stonebraker & Afifi, 2004). As resources are too abundant or redundant, they become contingency factors caused by the uncertainty of the HA/DR

environment (Kunz & Gold, 2017). Standardization of operations facilitates organizations' ability to align aspects of the supply chain that impact supply chain performance, such as warehousing, transportation, and storage (Ergun, 2010). In addition to avoiding misinformation, fostering information sharing, and facilitating interoperability with other HA/DR actors, standardization of operations improves all four dimensions of supply chain performance (Bui et al., 2000). Too much unnecessary or redundant information, too many or redundant logisticians with the incorrect specialty or an extremely bureaucratic administrative process deteriorate the benefits provided by standardization of operations. Therefore, contingency theory explains the following hypotheses:

H5bi:Resource redundancy deteriorates the positive relationship between standardization of operations and supply chain performance perception during humanitarian assistance and disaster response operations.

H5bii: Resource redundancy deteriorates the positive relationship between standardization of operations and supply chain performance efficiency during humanitarian assistance and disaster response operations.

H5biii: Resource redundancy deteriorates the positive relationship between standardization of operations and supply chain performance effectiveness during humanitarian assistance and disaster response operations.

H5biv: Resource redundancy deteriorates the positive relationship between standardization of operations and supply chain performance agility during humanitarian assistance and disaster response operations.

Continuing the use of contingency theory as the foundation for phenomena under study, when resources are too abundant and redundant, they become contingency factors caused by the uncertainty of the HA/DR environment (Kunz & Gold, 2017). Joint logistics facilitate organizations' ability to align aspects of the supply chain, which impacts supply chain performance, such as warehousing, transportation, and storage (Ergun, 2010). In addition to avoiding misinformation, fostering information sharing, and facilitating interoperability with other HA/DR actors, standardization of operations improves supply chain performance (Bui et al., 2000). Too much unnecessary or redundant information, too many or redundant logisticians with the incorrect specialty or an extremely bureaucratic administrative process deteriorate the benefits provided by standardization of operations. Excessive or redundant human and materiel resources can have a negative effect on standardization efforts, which will impact joint logistics efforts and postponement while deteriorating all four dimensions of supply chain performance. Therefore, contingency theory explains the following hypotheses:

H5ci: Resource redundancy deteriorates the positive relationship between joint logistics effort and supply chain performance perception during humanitarian assistance and disaster response operations.

H5cii: Resource redundancy deteriorates the positive relationship between joint logistics effort and supply chain performance efficiency during humanitarian assistance and disaster response operations.

H5ciii: Resource redundancy deteriorates the positive relationship between joint logistics effort and supply chain performance effectiveness during humanitarian assistance and disaster response operations.

H5civ: Resource redundancy deteriorates the positive relationship between joint logistics effort and supply chain performance agility during humanitarian assistance and disaster response operations.

H5di: Resource redundancy deteriorates the positive relationship between postponement and supply chain performance during humanitarian assistance and disaster response operations.

H5dii: Resource redundancy deteriorates the positive relationship between postponement effort and supply chain performance efficiency during humanitarian assistance and disaster response operations.

H5diii: Resource redundancy deteriorates the positive relationship between postponement effort and supply chain performance effectiveness during humanitarian assistance and disaster response operations.

H5div: Resource redundancy deteriorates the positive relationship between postponement effort and supply chain performance agility during humanitarian assistance and disaster response operations.

As I extensively discussed resource sharing and its role in supply chain performance, I will now outline the moderating role of resource scarcity in the relationship between resource sharing and the four dimensions of performance. Agency relationships are a part of any two-entity effort in which one party (the principal) gives authority to a second (the agent; Eisenhardt, 1989). When resources are shared in a humanitarian supply chain, the principal-agent relationship is between HA/DR actors executing the delivery of supplies for the greater good. As I experienced during HA/DR operations, that relationship can be hampered by the limited availability of

supplies (resources) at the relief location. This lack or limitation of resources deteriorates the existing relationships between the previously described principals and agents. For example, the agent does not deliver on previously agreed-to contracted relief supplies or does not have enough supplies at the relief location. These conditions not only create difficulties between the principal and the agent, but they deteriorate supply chain performance. Agency theory was used to explain the following hypotheses:

H6ai: Resource scarcity deteriorates the positive relationship between resource sharing and supply chain performance perception during humanitarian assistance and disaster response operations.

H6aii: Resource scarcity deteriorates the positive relationship between resource sharing and supply chain performance efficiency during humanitarian assistance and disaster response operations.

H6aiii: Resource scarcity deteriorates the positive relationship between resource sharing and supply chain performance effectiveness during humanitarian assistance and disaster response operations.

H6aiv: Resource scarcity deteriorates the positive relationship between resource sharing and supply chain performance agility during humanitarian assistance and disaster response operations.

As I continue to outline my research hypotheses, I explored the effects of resource scarcity on the relationship between standardization of operations on all four dimensions of supply chain performance. As resources are scarce or unavailable, they become contingency factors caused by the uncertainty of the HA/DR environment

(Kunz & Gold, 2017). I will continue using contingency theory as the foundation for the phenomena under study; when resources are scarce, they become contingency factors caused by the uncertainty of the HA/DR environment (Kunz & Gold, 2017). Limited or unavailable information, too few logisticians with the incorrect specialty, or limited warehouse space deteriorates the benefits of standardization of operations. Contingency theory explains the following hypotheses:

H6bi: Resource scarcity deteriorates the positive relationship between standardization of operations supply chain performance perception during humanitarian assistance and disaster response operations.

H6bii: Resource scarcity deteriorates the positive relationship between standardization of operations supply chain performance efficiency during humanitarian assistance and disaster response operations.

H6biii: Resource scarcity deteriorates the positive relationship between standardization of operations supply chain performance effectiveness during humanitarian assistance and disaster response operations.

H6biv: Resource scarcity deteriorates the positive relationship between standardization of operations supply chain performance agility during humanitarian assistance and disaster response operations.

The final set of hypotheses proffered seeks to explore the effects of the previously discussed moderator, resource scarcity on joint logistics effort, and postponement. Joint logistics efforts enable HA/DR actors to synchronize the HA/DR supply chain. Postponement refers to delaying product delivery to the latest possible time until users' orders are received (Van Hoek, 2001). As human and material resources become scarce,

they become contingency factors caused by the uncertainty of the HA/DR environment (Kunz & Gold, 2017). These contingency factors, brought into play by limited or unavailable resources, can deteriorate the relationship between joint logistics effort and all four dimensions of supply chain performance, and postponement and all four dimensions of supply chain performance. Contingency theory explains the following hypotheses:

H6ci: Resource scarcity deteriorates the positive relationship between joint logistics effort and supply chain performance perception during humanitarian assistance and disaster response operations.

H6cii: Resource scarcity deteriorates the positive relationship between joint logistics effort and supply chain performance efficiency during humanitarian assistance and disaster response operations.

H6ciii: Resource scarcity deteriorates the positive relationship between joint logistics effort and supply chain performance effectiveness during humanitarian assistance and disaster response operations.

H6civ: Resource scarcity deteriorates the positive relationship between joint logistics effort and supply chain performance agility during humanitarian assistance and disaster response operations.

H6di: Resource scarcity deteriorates the positive relationship between postponement and supply chain performance perception during humanitarian assistance and disaster response operations.

H6dii: Resource scarcity deteriorates the positive relationship between postponement and supply chain performance efficiency during humanitarian assistance and disaster response operations.

H6diii: Resource scarcity deteriorates the positive relationship between postponement and supply chain performance effectiveness during humanitarian assistance and disaster response operations.

H6div: Resource scarcity deteriorates the positive relationship between postponement and supply chain performance agility during humanitarian assistance and disaster response operations.

The research model outlines the relationships explored with the constructs outlined in Chapter 2. Surveying military and civilian logisticians who have participated in HA/DR operations enabled the examination and measurement of the moderating effects of resource scarcity and resource redundancy on the constructs' impact on supply chain performance. The identified effects will inform actions that should be undertaken as the U.S. military responds to future HA/DR operations. The unit of analysis was the military and civilian logisticians defined as: "responsible for ensuring that equipment and people are where they need to be precisely when they need to be there" (Joint Publication 4-0, 2019, p. GL-8). These first three chapters have outlined reasons for undertaking this research and the managerial constructs and hypotheses that served as a foundation for this research. Chapter IV contains the methodology used to complete this study.

IV: METHODOLOGY

This chapter contains the procedures to test the 12 theoretical hypotheses outlined in the previous chapter. I describe the research design, the sampling frame, the sample, the procedures undertaken to collect the data, how I operationalized the constructs and developed my scales, and end with a rationalization for conducting the survey, including the pilot study.

Design

A quantitative online survey was used to gather the data to test the hypotheses presented in chapter IV. I chose to use surveys since they are an appropriate tool due to their efficiency in reaching many subjects (Kerlinger & Lee, 2000). In addition, using this methodology allowed me to quantify responses and conduct statistical analysis of the results. I followed Dillman's (2000) Principles for Survey Instrument design, highlighting the importance of instructions and formatting, including the use of white space, navigational cues, and answer placement. Dillman's design method was the basis for the informed pilot, pilot test, and main study.

Sampling Frame

As outlined in previous chapters, logisticians are the critical element of any supply chain. For this study, I targeted logisticians who had participated in HA/DR operations supporting the U.S. military. The increasing number and severity of disasters have increased military organizations' role in disaster relief operations. Military organizations' organic supply chain capabilities enable them to move large numbers of materiel and personnel in support of HA/DR operations. These organic capabilities have saved numerous lives worldwide, with the most recent example being the U.S.

military's response to hurricanes Eta and Iota in Central America in November 2020. As in other recent HA/DR operations, logisticians were the key to successful HA/DR response and, therefore, the subject of the study.

Sample

Respondents were targeted from the U.S. Southern Command headquarters in Doral, FL, the Joint Staff in Washington, DC, Joint Task Force-Bravo in Honduras, the Pan-American Health Organization in Washington, DC, and other organizations that were working with the U.S. military in Central America at the time the survey was sent. To gain access to potential survey respondents, I obtained contact lists from military logistics career field leaders, logisticians from private volunteer organizations, and logisticians from international organizations who participated in HA/DR operations.

Following the Dillman (2000) survey design method, I conducted an informed pilot test and submitted the survey to the Florida International University (FIU) Institutional Review Board (IRB) for approval to conduct exempt social science research with human subjects. Once the IRB was approved, I developed a pilot study, followed by the final survey.

Instrument

To develop the instrument, I surveyed the literature, in which I obtained previously used scales to measure the constructs of interest. I first developed an informed pilot study to review the survey's wording, look, and feel. As recommended by Podsakoff et al. (2003), I included two marker variables to detect common method variance (CMV). The marker variable must not be theoretically related to the constructs of interest (Lindell & Whitney, 2001). I included two constructs as marker variables

that were theoretically unrelated to my study. The placement of the marker variables created some questions from the informed pilot subjects since their original look and feel were different from the constructs of interest.

Following the informed pilot, I made some wording modifications and other changes to the survey's functionality and launched the pilot study. The pilot was sent to individuals with previous logistics and supply chain experience; however, it did not go to individuals with HA/DR experience due to the limited target population size. It revealed that one of the marker variables was correlated to the constructs of interest; therefore, it could not be used as a CMV measure. Marker variable 1 was removed for the final study, and marker variable 2, subsequently identified as MRK2, was retained as a CMV measurement. In addition to removing one of the two marker variables, I made some verbiage changes to the final study to improve the survey's clarity and flow.

The subjects in my pilot study responded to 52 questions used to measure the hypotheses outlined in the theoretical model, followed by nine demographic questions. In addition, I asked several follow-up verbal questions related functionality of the survey. A majority of respondents were male, members of the armed forces, worked at U.S. Southern Command, earned a graduate degree, and had attended some logistics training.

Following the collection of responses, the data were downloaded from Qualtrics and uploaded to SPSS 26 statistics software for further analysis. There were a few missing values in some of the surveys, which did not threaten the survey's integrity. As I examined the results, missing values accounted for less than 1% of all responses. I measured standard deviations and means for each of the 52 scale items and tested normality. The majority of the scales are statements, and the majority of response choices

were based on a five-point scale ranging from *strongly disagree* to *strongly agree*. The five-point scales resource redundancy and resource scarcity were two of the exceptions. Their responses ranged from *highly likely* to *highly unlikely*. The additional exceptions were: resource measures, output measures, and flexibility measures whose five-point Likert scale responses ranged from *never* to *always*.

Mean values ranged from 1.11 to 4.69, while standard deviations ranged from 0.24 to 1.142. Kurtosis and skewness were also tested; however, due to the small sample size of the pilot survey, the highest kurtosis value was 35, and the lowest skewness value was -5.92. These values are out of the normality range for both kurtosis and skewness; however, they appear to depend on sample size. Wheeler (2008) stated that even with a sample size of several hundred, kurtosis and skewness can manifest due to the small sample size. These values can be attributed to the military attitude of accomplishing the mission regardless of obstacles outlined by Feaver (2009). As we look at the skewness of the survey's responses, one can understand why there is no "normal" distribution. Military respondents are less like to say, "I cannot do it" (Feaver, 2009). The analysis revealed that scales demonstrated coefficient alpha values of 0.70 or above, and most evaluated items showed strong loadings on single factors.

Independent Variables

Resource sharing between HA/DR actors helps enhance efficiency in a disaster operation, while not sharing resources may lead to a waste of resources and critical response time (Pazirandeh & Maghsoudi, 2017). In addition, resource sharing has been found to improve supply chain performance, specifically related to on-time deliveries and lowering warehousing costs. Resource sharing was measured using items developed

from the supply chain literature (Jap 1999; Stephenson & Schnitzer, 2006; Tomasini & Van Wassenhove, 2009). Using a 1 through 5 Likert scale with 1 representing *strongly disagree* and 5 meaning *strongly agree*, I used the following five scales:

1. RSS1 – Our organization shares lessons learned with other HA/DR actors at the disaster location.
2. RSS2 – Our organization shares information with affected local communities to assess their needs.
3. RSS3 – Our organization shares its logistics infrastructure (personnel and materiel) with other HA/DR actors.
4. RSS4 – Our organization shares affected community assessment information with other HA/DR actors.
5. RSS5 – Our organization shares its supplies with other HA/DR actors.

Standardization of operations enables organizations to align information, warehousing, delivery, transportation, transportation, and storing (Ergun, 2010). Standardization can help avoid misinformation, enhance information sharing, and optimize interoperability, improving supply chain performance (Bui et al., 2000). Standardization of operations was measured using items developed from the supply chain literature (Ergun et al., 2010; Gatignon et al., 2010; Thomas, 2004; Van der Laan et al., 2009). Using a 1 through 5 Likert scale with 1 representing *strongly disagree* and 5 meaning *strongly agree*, I used the following five scales:

1. SOP1 – Our organization uses a standard coordination plan for disaster relief.

2. SOP2 – Our organization uses internationally accepted ‘Sphere Project' HA/DR standards.
3. SOP3 – Our organization supports the standardization of means of communication.
4. SOP4 – Our organization supports the standardization of information.
5. SOP5 – Our organization uses standardized processes during HA/DR operations.

Joint logistics effort enables organizations to synchronize their activities. It is conceptualized as joint forecasting, replenishment management, joint inventory, assortment planning, and collaborative transportation (Simchi-Levi et al., 2007). These activities help the organization synchronize and use scarce resources efficiently (Kovacs and Spens 2009). Joint logistics effort was measured using items developed from the supply chain literature (Van der Laan et al., 2009).

Using a 1 through 5 Likert scale with 1 representing *strongly disagree* and 5 meaning *strongly agree*, I used the following four scales:

1. JLE1 – Our organization supports the use of collaborative transportation.
2. JLE2 – Our organization conducts joint forecasts of aid supply replenishment with other HA/DR actors.
3. JLE3 – Our organization conducts joint forecasts of aid supply inventory with other HA/DR actors.
4. JLE4 – Our organization shares supply stock level information with other HA/DR actors.

Postponement allows HA/DR actors to delay the delivery of relief supplies to the last possible moment so they can be adapted to the requirements of the area affected by a disaster (Tomasini & Van Wassenhove, 2009). Postponement is a cost-effective substitute to prepositioning, helping facilitate the assignment of relief supplies as expeditiously as possible, thereby enhancing supply chain performance (Oloruntoba & Gray, 2006). Postponement was measured using items developed from the supply chain literature (Van der Laan et al., 2009). Using a 1 through 5 Likert scale with 1 representing *strongly disagree* and 5 meaning *strongly agree*, I used the following four scales:

1. POS1 – Our organization delays ordering additional aid supplies until community needs are assessed.
2. POS2 – Our organization supports postponing the deployment of additional personnel until requested by responding units.
3. POS3 – Our organization pools and holds unlabeled aid supplies until the call for their requirement comes.
4. POS4 – Our organization supports postponing the deployment of additional personnel until response units request them.

Marker Variable

To control for common method variance (CMV), I followed Podsakoff et al. (2003) and included a marker variable that measures a theoretically unrelated construct. The marker variable, leadership and process improvement, was measured adapting items from the leadership management literature (Zhu et al., 2005). Using a 1 through 5 Likert

scale with 1 representing *strongly disagree* and 5 meaning *strongly agree*, I used the following four scales:

1. MRK2-1 – My organization's leadership is actively supporting process improvement activities.
2. MRK2-2 – My organization's leadership accepts responsibility for process improvement.
3. MRK2-3 – My organization's leadership is actively participating in process improvement activities.
4. MRK2-4 – My organization's leadership often discusses process improvement activities in senior leadership meetings.

Dependent Variables

Resource measures (efficiency) principally consider operational costs, cost of resources used, personnel costs, and cost of placing orders; Balcik and Beamon (2008) conceptualized it as one of the four dimensions of supply chain performance. I measured resource (efficiency) using items from humanitarian supply chain literature (e.g., Beamon 1999; Beamon & Balcik, 2008). Using a 1 through 5 Likert scale with 1 representing *never* and 5 representing *always*, I used the following five scales:

1. RME1 – Our organization delivers aid to the required disaster location on time.
2. RME2 – Our organization dispenses aid to affected population on time.
3. RME3 – Our organization dispenses aid within the assigned budget.
4. RME4 - Our organization dispenses aid by efficiently using assigned personnel.

5. RME5 – Our organization establishes reorder levels to ensure aid is available as required.

Output measures (effectiveness) principally evaluate the quantity of aid supply (throughput) and can be used to show aid delivery effectiveness to potential donors and stakeholders (Balcik & Beamon, 2008). Output (effectiveness) was measured using items from humanitarian supply chain literature (e.g., Beamon 1999; Beamon & Balcik, 2008). Using a 1 through 5 Likert scale with 1 representing *never* and 5 representing *always*, I used the following five scales:

1. OME1 – Our organization cross-leveled supplies with other HA/DR actors.
2. OME2 – Our organization achieved its target fill rate.
3. OME3 – Our organization provided stock capacity soon after arrival at the disaster location.
4. OME4 – Our organization provided a consistent amount of relief supplies.
5. OME5 – Our organization met minimum response time (i.e., time between occurrence and arrival at disaster location).

Flexibility measures consider the ability to respond to different disasters of varying degrees and scale, provide various types of aid supplies and respond to varying types of affected populations (Balcik & Beamon, 2008). Flexibility (agility) was measured using items from humanitarian supply chain literature (e.g., Beamon 1999; Beamo & Balcik, 2008). Using a 1 through 5 Likert scale with 1 representing *never* and 5 representing *always*, I used the following five scales:

1. FME1 – Our organization quickly provided different types of aid supply to the affected population.

2. FME1 – Our organization contacted different suppliers simultaneously.
3. FME3 – Our organization quickly changed the output level.
4. FME4 – Our organization adapted dispensing aid times to local needs.
5. FME5 – Our organization integrated new relief items to the aid supply chain.

As outlined earlier, supply chain performance perceptions are an important indicator that can influence supply chain performance (Pushpamali, 2021). Supply chain performance perceptions were measured using supply chain literature items (e.g., Beamon 1999; Beamon & Balcik, 2008). Using a 1 through 5 Likert scale with 1 representing *never* and 5 representing *always*, I used the following five scales:

1. SCI1 – Our organization's supplies consistently arrived on time.
2. SCI2 – Our organization adjusted to changes in relief supply requirements.
3. SCI3 – Our organization supported the mission within the assigned budget.
4. SCI4 – Our organization did not run out of humanitarian supplies.
5. SCI5 – Our organization supported the mission without requesting additional personnel.

Survey Layout

The survey's layout complied with the recommendations made by Dillman (2000). I used Qualtrics software which started with an informational page that provided subjects with information regarding the survey's purpose and my phone number, and informed subjects that it was an entirely voluntary survey and that participants could withdraw from the study at any time. A copy of the survey is included in the appendix. Following the informational page, there were some basic questions about the respondents' military affiliation and organization where they work.

Seven Qualtrics blocks followed the initial questions with questions for each of the measured constructs. The final block contained demographic questions that outlined the descriptive statistics of the survey.

Scale validity

I used the procedures and processes outlined by Garver and Mentzer (1999) to address discriminant validity, convergent validity, reliability, and unidimensionality. I used the measures outlined by Hattie (1985) to assess unidimensionality by verifying the existence of only one construct in a set of corresponding measures. Using exploratory factor analysis (EFA), I tested each construct; then, I tested them for all possible pairs. Finally, I measured the model's constructs together with other constructs (Garver & Mentzer, 1999).

I measured reliability by using Cronbach's alpha coefficient values and established a cut-off value of 0.70. In general, when we evaluate the value of Cronbach's alpha, a value above 0.70 indicates a good correlation between the items and the actual scale scores (Churchill, 1979). I also calculated variance extracted using EFA (Garver & Mentzer, 1999). I assessed construct validity by using convergent and discriminant validity. Convergent validity describes the grouping or convergence of various measurements of the same construct on one statistical factor. Discriminant validity assesses how measurements from different constructs load on other factors. Convergent validity was measured using Garver and Mentzer (1999) by determining the magnitude, direction, and statistical significance of variables' estimated parameters. Discriminant validity was evaluated by using paired correlation of the constructs.

Correlations among the measurement model constructs were compared to the theoretical model by using the appropriate tests.

Constructs used for this study had been previously tested empirically. The scales for resource sharing, standardization of operations, postponement, joint logistics effort, resource redundancy, resource scarcity, supply chain performance impressions, supply chain performance resource measures (efficiency), supply chain performance output measures (effectiveness), supply chain performance flexibility measures (agility), and supply chain performance perceptions were adapted from previous studies with some needed alterations.

My pilot survey was distributed in the manner outlined by Dillman (2000). Using my personal (non-U.S. government e-mail account), I sent the survey link to approximately 50 U.S. Southern Command supply chain enterprise members, drawing from a database held by the U.S. Southern Command Directorate for Logistics. Participants were asked to respond to the initial survey and discuss their thoughts on the survey's functionality, clarity, and relevancy. There were 50 potential pilot test subjects; 42 completed the survey, which resulted in a response rate of 84%. This response rate far exceeded the expected response rate of 14% for military respondents outlined by Miller and Eyal (2015).

Final Survey Sample Selection

Following the completion and analysis of the pilot, the final version of the instrument (with all recommended modifications) was developed. The appendix contains the final version of this study's survey. The potential respondents were selected from lists provided by the U.S. Southern Command's Directorate of Logistics and U.S. Southern

Command's Partnership and Coalition Directorate. The lists included members of the Department of Defense's Logistics Enterprise and non-governmental organizations, private volunteer organizations, and non-U.S. military logisticians that routinely work with U.S. Southern Command during HA/DR operations. The selection criterion included logisticians who participated in an HA/DR operation within the last 11 years. The timing criteria were selected to ensure potential respondents had participated in Operation Unified Response, the HA/DR relief operation conducted in the wake of the 2010 Haiti earthquake.

To reduce potential U.S. military service bias, the survey's target population was expanded to include military and civilian personnel from Guatemala, Honduras, and Panama. In accordance with the established criteria, an e-mail inviting participants to participate was crafted and sent to 500 potential respondents. Since no personally identifiable information, a reminder e-mail was sent with apologies if they had already completed the survey. Two reminder e-mails were sent within one week of each other.

This procedure resulted in 207 respondents submitting their completed survey (41.4 % of the 500 targeted respondents). Missing responses in the survey ranged from 0.9% to 1.9% in each question, and they did not represent a significant impact on the survey's data integrity. Like the pilot survey, scales were analyzed using SPSS 26 software which demonstrated some normality issues due to high levels of skewness and kurtosis. A closer look at the survey showed that kurtosis and skewness were potentially due to the social desirability bias. The bias mentioned above is the tendency to paint oneself positively in terms of current mores and folkways (Mick, 1996). The reason for

highlighting this bias in the study is that HA/DR operations are about providing relief and saving lives.

As stated earlier, the military attitude of accomplishing the mission regardless of obstacles was outlined by Feaver (2009). Responses to both the pilot study and the main study reflected *strongly agree* or *somewhat agree* answers on over 70% of surveys. For example, to scale items such as: "Our organization shares its supplies with other HA/DR actors," over 74% of such responses were reflected. As a retired member of the U.S. military, I can attest to the "failure is not an option" statement that has always been a part of the military's culture. The sample's specific characteristics are outlined in Tables 1 and 2.

Table 1

Military Membership and Education

Variables (n-207)	Frequency	Percentage
Military Affiliation		
U.S. Military	155	73.10%
Civilian	57	26.90%
Military Service		
U.S. Army	65	30.70%
U.S. Navy	38	17.90%
U.S. Air Force	19	9.00%
U.S. Marines	17	8.00%
U.S Space Force	9	4.20%
Non-U.S. Military	7	3.70%
Level of Education		
High School	11	5.20%
Associate's Degree	8	3.80%
Bachelor's Degree	82	38.70%
Master's Degree	88	41.50%
PhD, Edd, DBA, MD, JD, etc	18	8.50%
Logistics Course Attended		
Army Logistics Specialist	8	3.80%
Logistics Captains Course	16	7.50%
USAF Multinational Logistics	6	2.80%
USAF Theater Logistics	8	3.80%
Navy Logistics Specialist	10	4.70%
USN Supply Basic Course	9	4.20%
U.N. Logistics Course	38	17.90%
Graduate Logistics	39	18.40%
Course not listed above	56	26.40%
No logistics Training	17	8.00%

Table 2

Sample Characteristics

Variables (n-207)	Frequency	Percentage
Gender		
Male	128	61.60%
Female	79	38.20%
Country of Origin		
Honduras	19	9.00%
Guatemala	12	5.70%
Panama	11	5.20%
Unites States of America	165	77.80%
Survey Language		
English	177	83.50%
Spanish	35	16.50%
Respondent's Organization		
U.S. Africa Command	28	13.20%
U.S. Central Command	20	9.40%
U.S. Pacific Command	24	11.30%
U.S. Southern Command	56	26.40%
U.S. Department of State	6	2.80%
U.S. Agency for International Development	7	3.30%
Defense Health Agency	9	4.20%
Defense Logistics Agency	14	6.60%
The Joint Staff	11	5.20%
Non-Governmental Organization	10	4.70%
Non-U.S. Organization	27	12.70%
Years of HA/DR Experience		
0-2 years	31	14.60%
2-5 years	48	22.60%
5-7 years	42	19.80%
7-10 years	38	17.90%
Over 10 years	48	22.60%

I followed recommendations outlined by Garver and Mentzer (1999) by performing tests that included EFA and regression to evaluate variable properties outlined in the research model to measure and assess all individual constructs' validity

and reliability. I used the SPSS 26 software package to develop the model and to conduct statistical analysis. Scale reliability was once again measured using Cronbach's alpha values, with all values in the final survey exceeding the recommended value of 0.7. Convergent validity describes how different measures of the same construct aggregate on the same factor (Mentzer & Flint, 1997). Statistically, one can achieve it in one's study when scales load sufficiently on the constructs they were crafted to measure. Since I am using regression, the loading of an item in its intended construct or dimension demonstrates convergent validity. As I explore convergent validity, Garver and Mentzer (1999) restated that factor loadings at 0.7 or higher are a good measure of convergent validity; however, values as low as 0.4 can be acceptable. All values for this study were acceptable. When looking at discriminant validity, I measured the loadings of the constructs on interest and their loads on each factor (i.e., how they discriminate from each other). Due to their characteristics, certain constructs may be correlated to each other but should not load together on one variable. I examined correlated items to explore their potential removal of variables from the study. I chose to keep all of the variables due to the sample size and the narrow and specialized population targeted for this survey. According to Anderson and Gerbing (1988), scales with discriminant validity and convergent validity are considered unidimensional. For this study, scales demonstrated both discriminant and convergent validity. Table 3 outlines reliability and descriptive statistics for the independent variables (IV) used in this study.

Table 3

IV Reliability and Descriptive Statistics

Resource Sharing (RSS)						
Scale	Cronbach's Alpha (CA)	Mean	Std. Dev.	Skewness	Kurtosis	CA if item deleted
RSS1.	0.92	3.91	1.35	-1.08	-0.12	0.91
RSS2		4.00	1.38	-1.213	0.99	0.91
RSS3		3.90	1.39	-1.027	-0.35	0.90
RSS4.		4.00	1.32	-1.242	0.29	0.90
RSS5		3.90	1.47	-1.09	-0.27	0.90

Synchronization of Operations (SOP)						
Scale	Cronbach's Alfa (CA)	Mean	Std. Dev.	Skewness	Kurtosis	CA if item deleted
SOP1	0.91	4.19	1.09	-1.48	1.48	0.90
SOP2		4.01	1.25	-1.18	0.31	0.89
SOP3		4.30	1.00	-1.65	2.31	0.88
SOP4		4.33	1.03	-1.80	2.74	0.89
SOP5		4.20	1.11	-1.46	1.38	0.89

Joint Logistics Effort (JLE)						
Scale	Cronbach's Alfa (CA)	Mean	Std. Dev.	Skewness	Kurtosis	CA if item deleted
JLE1	0.90	4.43	0.97	-2.09	4.16	0.91
JLE2		4.01	1.26	-1.20	0.34	0.85
JLE3		4.01	1.29	-1.15	0.06	0.85
JLE4		4.04	1.19	-1.32	0.87	0.86

Postponement (POS)						
Scale	Cronbach's Alfa (CA)	Mean	Std. Dev.	Skewness	Kurtosis	CA if item deleted
POS1	0.88	3.77	1.35	-0.87	0.45	0.85
POS2		3.94	1.22	-1.12	0.32	0.82
POS3		4.03	1.19	-1.17	0.46	0.84
POS4		4.14	1.11	-1.30	0.89	0.86

Table 4 outlines reliability and descriptive statistics for the marker and moderator variables used in this study.

Table 4

Marker & Moderator Variables' Reliability and Descriptive Statistics

Marker Variable (MRK)

Scale	Cronbach's Alfa (CA)	Mean	Std. Dev.	Skewness	Kurtosis	CA if item deleted
MRK1		3.20	1.34	-0.33	-1.06	0.86
MRK2		3.03	1.26	-0.18	-1.01	0.84
MRK3	0.89	3.24	1.24	-0.32	-0.92	0.84
MRK4		3.15	1.31	-0.23	-1.00	0.89

Resource Redundancy (RRE)

Scale	Cronbach's Alfa (CA)	Mean	Std. Dev.	Skewness	Kurtosis	CA if item deleted
RSS1		4.25	1.17	-1.56	1.39	0.77
RSS2		4.39	0.98	-1.90	3.35	0.74
RSS3	0.82	4.48	0.94	-2.10	4.04	0.74

Resource Scarcity (RSC)

Scale	Cronbach's Alfa (CA)	Mean	Std. Dev.	Skewness	Kurtosis	CA if item deleted
RSS1		4.02	1.40	-1.18	0.10	0.61
RSS2		4.01	1.35	-0.95	-0.20	0.67
RSS3	0.81	4.16	1.15	-1.08	1.06	0.81

Table 5 outlines reliability and descriptive statistics for the dependent variables (DV) used in this study.

Table 5

Dependent Variable (DV) Reliability and Descriptive Statistics

Resource Measures (Efficiency) (RME)						
Scale	Cronbach's Alfa (CA)	Mean	Std. Dev.	Skewness	Kurtosis	CA if item deleted
RME1	0.91	3.13	1.03	-1.63	2.66	0.88
RME2		3.26	1.04	-1.64	2.20	0.88
RME3		3.41	1.02	-2.03	3.70	0.88
RME4		3.14	1.10	-1.43	1.46	0.89
RME5		3.03	1.28	-1.27	0.42	0.90

Performance Measures (Effectiveness) (OPM)						
Scale	Cronbach's Alfa (CA)	Mean	Std. Dev.	Skewness	Kurtosis	CA if item deleted
OPM1	0.89	2.92	1.36	-1.02	-0.30	0.88
OPM2		3.18	1.06	-1.43	1.48	0.86
OPM3		3.18	1.09	-1.39	1.31	0.87
OPM4		3.21	1.06	-1.51	1.72	0.88
OPM5		3.19	1.05	-1.47	1.71	0.87

Flexibility Measures (Agility) (FLM)						
Scale	Cronbach's Alfa (CA)	Mean	Std. Dev.	Skewness	Kurtosis	CA if item deleted
FLM1	0.91	3.29	1.02	-1.66	1.40	0.90
RSS2		3.42	1.02	-1.99	4.69	0.90
RSS3		3.04	1.24	-1.27	0.48	0.89
RSS4.		3.13	1.22	-1.38	0.89	0.89
RSS5		3.16	1.20	-1.39	0.88	0.88

Supply Chain Performance Perceptions						
Scale	Cronbach's Alfa (CA)	Mean	Std. Dev.	Skewness	Kurtosis	CA if item deleted
SCI1	0.91	4.08	0.92	-1.44	2.46	0.88
RSS2		4.08	1.02	-1.38	1.57	0.89
RSS3		4.36	0.96	-1.98	4.02	0.89
RSS4		4.10	1.16	-1.33	0.89	0.90
RSS5		4.61	1.14	-1.45	1.28	0.90

As I explored the relationships between the constructs, multicollinearity issues with high variance inflation factor (VIF) values exceeded the recommended value of five and a tolerance value of less than 0.01. However, since we are analyzing a moderated relationship in this model, McClelland et al. (2016) stated that multicollinearity was a

"red herring" when interpreting moderated multiple regression models. They refuted the conclusions of other researchers who stressed the importance of multicollinearity when measuring moderation. Therefore, I assumed that multicollinearity was not an issue for this study.

Common Method Variance (CMV)

Researchers have divergent opinions regarding CMV or common method bias (Podsakoff et al., 2003) and its impact on self-report quantitative studies. Malhortra et al. (2006) posited that all researchers should control and reduce CMV's potential impact. I took several measures to reduce CMV's influence on this study. I ensured that the pilot and final survey subjects had relevant subject matter experts: logisticians who had participated in HA/DR operations. I then informed the respondents that their responses were completely anonymous and that I would not collect personally identifiable information. I included a marker variable adopted from Zhu et al. (2005) in my final study to analyze and control for CMV's potential effects. When I selected the CMV measurement construct, I chose one unrelated to my research, placed it in the survey, and allowed it to co-vary with all the other constructs. I used four items in this construct and put them between the dependent and independent variables to provide temporal separation between them, as recommended by Podsakoff et al. (2003). As with the pilot study, none of the survey constructs were correlated at the 0.05 level (statistically significant), which shows that CMV was not a major concern for this research. I selected linear regression to model the relationship between a scalar response and one or more exploratory variables (Kutner et al., 2004). The following chapters will explore the data analysis, findings, and contributions to the literature.

V: RESULTS

In this chapter, I will outline my final survey results. Each of the supply chain performance measurement dimensions is independent and is not second-order formative constructs. Therefore, I used linear regression to test the hypothesized interactions between the constructs.

Hypotheses Testing

Following the model refinement and validation, I tested the relationships presented in Figure 2 which shows the results of the regression model.

Figure 2

Regression Results

	Efficiency			Effectiveness			Agility			Percention		
Model	Beta	t	Sig.	Beta	t	Sig.	Beta	t	Sig.	Beta	t	Sig.
(Constant)	-1.36	-2.72	0.01	-1.23	-2.19	0.03	-1.19	-2.10	0.04	-1.26	-2.59	0.10
R_SCARCE	0.00	0.25	0.98	0.04	0.72	0.47	-0.04	-0.87	0.38	-0.03	-0.06	0.95
R_REDUN	0.33	2.58	0.01	0.31	2.22	0.03	0.38	2.26	0.01	0.34	2.77	0.01
O_STAND	1.08	3.54	0.00	0.96	2.80	0.01	0.67	1.89	0.06	0.91	3.03	0.00
O_JOINT	0.43	1.51	0.13	0.37	1.17	0.25	0.92	2.78	0.01	0.57	2.06	0.04
O_POSTP	-0.46	-1.20	0.23	-0.46	-1.06	0.29	-0.63	-1.43	0.15	-0.52	-1.38	0.17
M_OS_RR	-0.16	-2.22	0.03	-0.17	-2.09	0.04	-0.09	-1.04	0.30	-0.14	-1.97	0.05
M_OJ_RR	-0.06	-0.93	0.36	-0.01	-0.15	0.88	-0.13	-1.71	0.09	-0.07	-1.05	0.30
M_OP_RR	0.15	1.78	0.08	0.13	1.40	0.16	0.16	1.61	0.10	0.15	1.78	0.08

The following figures outline the relationships and their significance, followed by a list of the hypotheses tested during the analysis. Following Baron and Kenny (1986), I

first tested for the direct effects of all independent variables on all four dimensions of the dependent variable. Using supply chain perception as the dependent variable, resource sharing had no direct effect that was statistically significant on supply chain perception. However, standardization of operations, joint logistics effort, and postponement all had a positive direct effect on supply chain perception. Removing resource sharing from the initial model had no significant effect on the model since the R squared is minimally reduced from 0.633 to 0.632, the standard error of the estimate is reduced from 0.56512 to 0.56448, and the standard error coefficients remained unchanged at 0.224. Given this minimal impact, I measured the moderation effects on the model without the presence of resource sharing. In addition, resource scarcity did not have a direct effect on the independent variable; however, resource redundancy has a direct effect on the independent variable. The relevant statistical values are reflected in Figures 3-6, which depict the interactions between the constructs used in my research model. Figure 3 outlines that resource redundancy, standardization of operations, and joint logistics effort have a positive direct effect on the supply chain performance perception, whereas resource redundancy has a negative moderating effect on standardization of operations. In other words, redundant resources deteriorate standardization of operations' positive effect on supply chain performance. In my personal experience, I observed that too many or redundant resources arrived at the Port au Prince Airport in Haiti during HA/DR operation in the wake of the 2010 earthquake. These excess or redundant resources prevented logisticians from standardizing the supply chain, which would have had a positive direct effect on supply chain performance perceptions.

Figure 3

Results – Perception

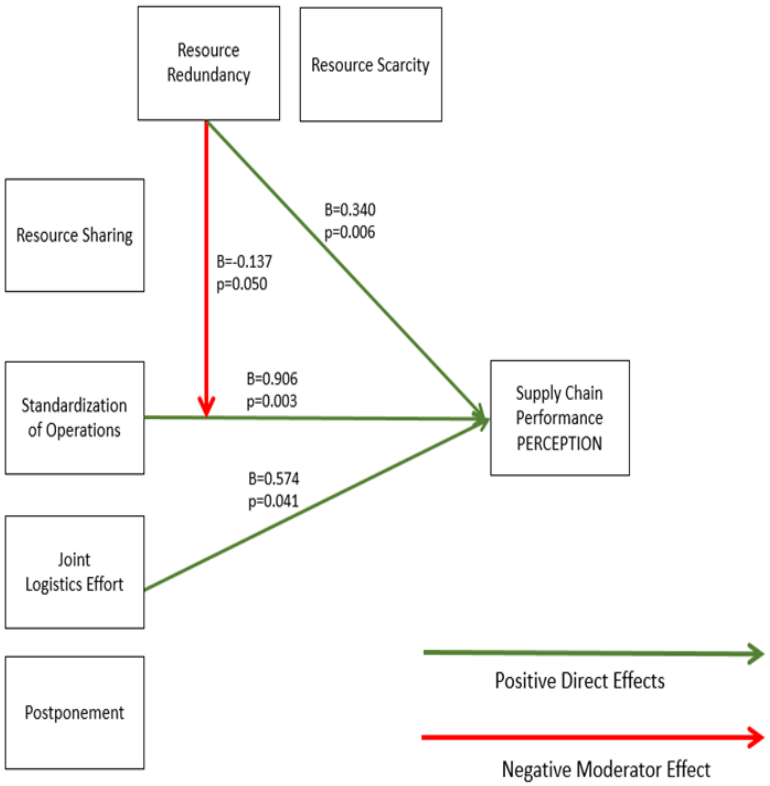


Figure 4 depicts the interaction between the variables using resource measures (efficiency) as an independent variable. It can be observed that resource redundancy and standardization of operations have a positive direct effect on supply chain performance efficiency, whereas resource redundancy has a negative moderating effect on standardization of operations' relationship with supply chain performance efficiency.

Figure 4

Results - Efficiency

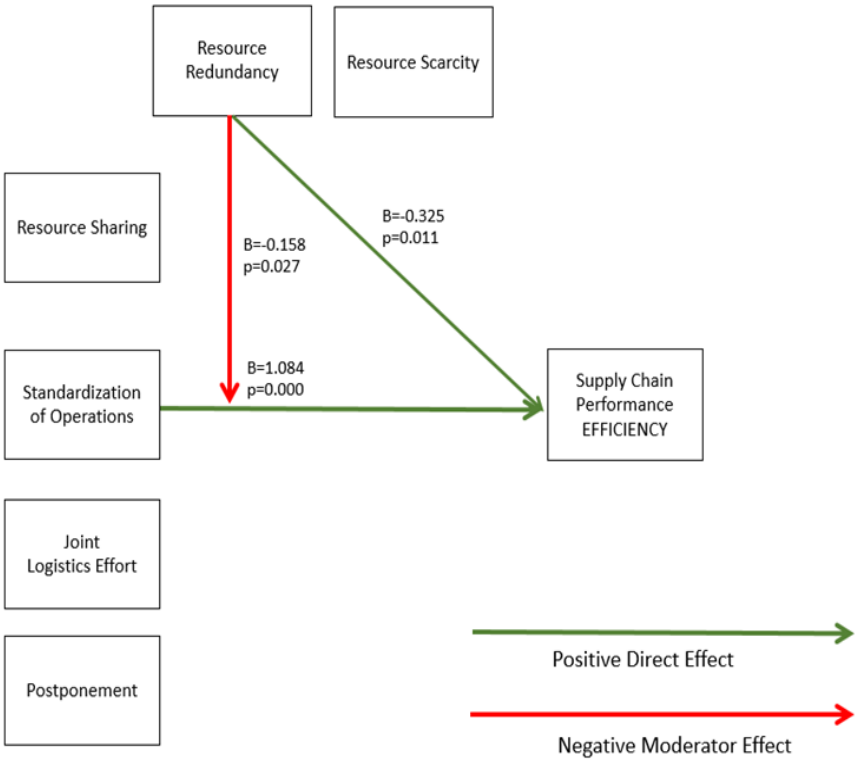


Figure 5 depicts the interaction between the variables using output measures (effectiveness) as an independent variable. We can observe that resource redundancy and standardization of operations have a positive direct effect on supply chain performance efficiency, whereas resource redundancy has a negative moderating effect on standardization of operations' relationship with supply chain performance efficiency.

Figure 5

Results - Effectiveness

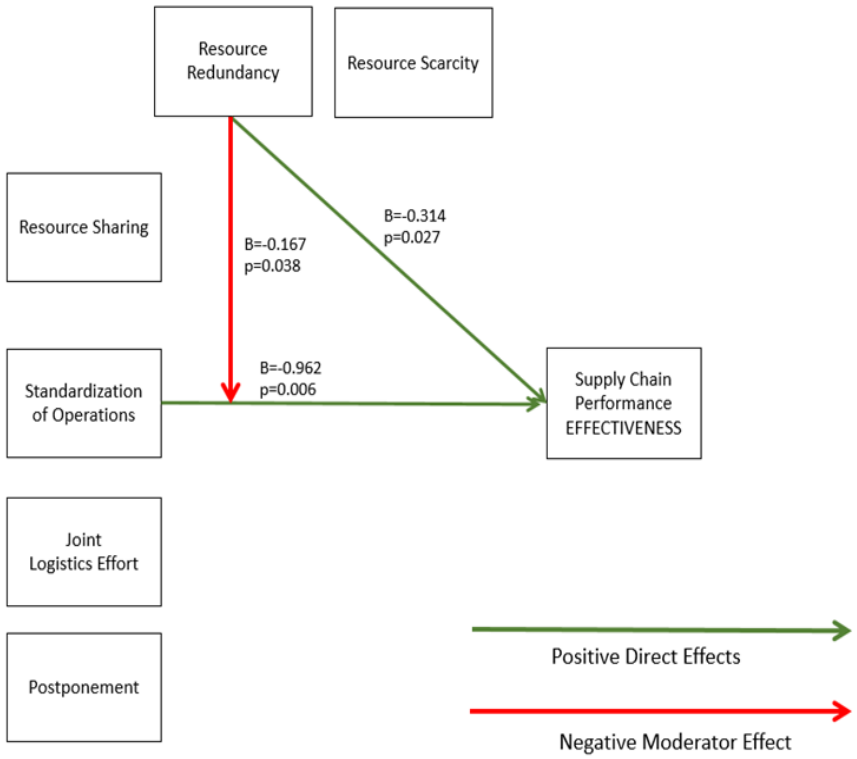
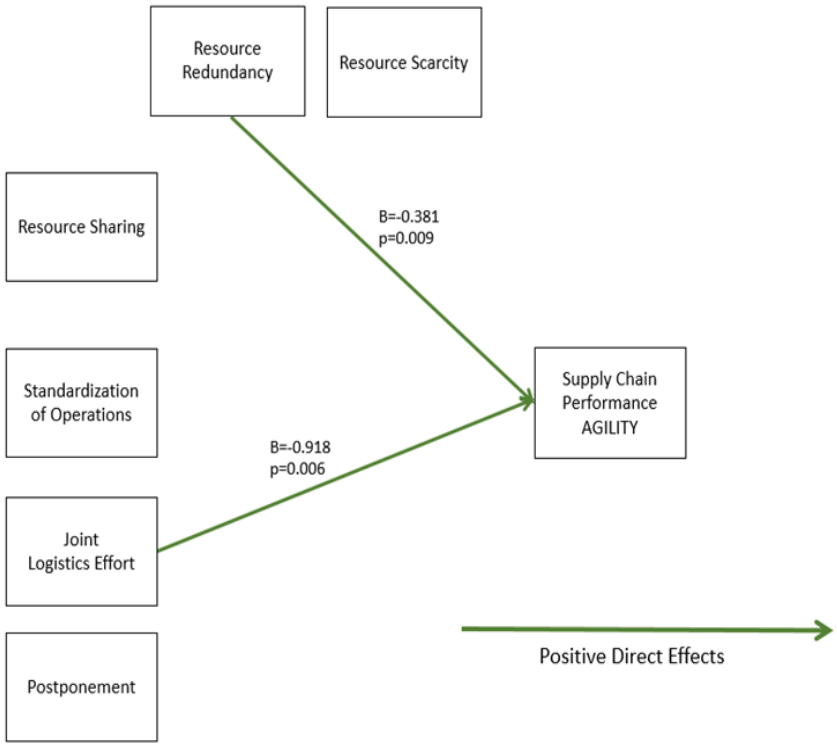


Figure 6 depicts the interaction between the variables using flexibility measures (agility) as an independent variable. We can observe that resource redundancy and joint logistics effort have a positive direct effect on supply chain performance efficiency. There are no other relationships that are of statistical significance.

Figure 6

Results - Agility



Moderator Variables

Resource redundancy, also known as aid surplus and duplication of efforts, can slow down or deteriorate supply chain performance (Maghsoudi et al., 2018). Resource redundancy was measured using items from supply chain literature (Balcik et al. 2010; Larson, 2012, Skoglund & Hertz, 2012; Stephenson, 2005). Using a 1 through 5 Likert scale with 1 representing *extremely unlikely* and 5 meaning *extremely likely*, I used the following three scales:

1. RRE1 – Redundant logistics personnel specialties at the relief location.
2. RRE2 – Redundant efforts in administrative aspects of humanitarian relief.

3. RRE3 – Redundant aid supplies provided by several actors with similar products.

Resource scarcity, referring to limited aid supplies, trained logisticians, warehouse space, and transportation, deteriorate the relationships between coordination modes and performance outcomes. Resource scarcity was measured using items from supply chain literature (Balcik et al., 2010; Larson, 2012, Skoglund & Hertz, 2012; Stephenson, 2005). Using a 1 through 5 Likert scale with 1 representing *extremely unlikely* and 5 meaning *extremely likely*, I used the following three scales:

1. RSS1 – Lack of supplies at the relief location.
2. RSS2 – Lack of professional logisticians at the relief location.
3. RSS3 – Lack of availability of local warehouses to store supplies in disaster-prone areas.

Hypotheses Results

As shown in the previous four figures, I measured direct and moderating effects. The results are reflected in Tables 6-8.

Table 6

Hypotheses Part 1: Direct Effects

Hypotheses Part 1	Construct/ Citation	Supported/ Not supported
H1a If resource sharing increases, the supply chain performance perception will increase during humanitarian assistance and disaster response operations.	Balcik et al., 2010 Resource-Based View (RBV)	Not supported
H1b If resource sharing increases, the supply chain performance efficiency will increase during humanitarian assistance and disaster response operations.	Balcik et al., 2010 RBV	Not supported
H1c If resource sharing increases, the supply chain performance effectiveness will increase during humanitarian assistance and disaster response operations.	Balcik et al., 2010 RBV	Not supported
H1d If resource sharing increases, the supply chain performance agility will increase during humanitarian assistance and disaster response operations.	Balcik et al., 2010 RBV	Not supported
H2a If standardization of operations increases, then supply chain performance perception will increase during humanitarian assistance and disaster response operations.	Van Wassenhove and Pedraza Martinez, 2010 Network Theory (NT)	Supported
H2b If standardization of operations increases, then supply chain performance efficiency will increase during humanitarian assistance and disaster response operations.	Van Wassenhove and Pedraza Martinez, 2010 Network Theory (NT)	Supported
H2c If standardization of operations increases, then supply chain performance effectiveness will increase during humanitarian assistance and disaster response operations.	Van Wassenhove and Pedraza Martinez, 2010 Network Theory (NT)	Supported
H2d If standardization of operations increases, then supply chain performance agility will increase during humanitarian assistance and disaster response operations.	Van Wassenhove and Pedraza Martinez, 2010 Network Theory (NT)	Not supported
H3a If joint logistics efforts increase, then supply chain performance perception will increase during humanitarian assistance and disaster response operations.	Simchi-Levi et al, 2007 NT	Supported
H3b If joint logistics efforts increase, then supply chain performance efficiency will increase during humanitarian assistance and disaster response operations.	Simchi-Levi et al, 2007 NT	Not supported
H3c If joint logistics efforts increase, then supply chain performance effectiveness will increase during humanitarian assistance and disaster response operations.	Simchi-Levi et al, 2007 NT	Not supported
H3d If joint logistics efforts increase, then supply chain performance agility will increase during humanitarian assistance and disaster response operations.	Simchi-Levi et al, 2007 NT	Supported
H4a If postponement increases, then supply chain performance perception will increase during humanitarian assistance and disaster response operations.	Van Hoek, 2001 NT	Not supported
H4b If postponement increases, then supply chain performance efficiency will increase during humanitarian assistance and disaster response operations.	Van Hoek, 2001 NT	Not supported
H4c If postponement increases, then supply chain performance effectiveness will increase during humanitarian assistance and disaster response operations.	Van Hoek, 2001 NT	Not supported
H4d If postponement increases, then supply chain performance agility will increase during humanitarian assistance and disaster response operations.	Van Hoek, 2001 NT	Not supported

Table 7

Hypotheses Part 2: Resource Redundancy as a Moderator

Hypotheses Part 2	Construct/ Citation	Supported/ Not supported
H5ai Resource redundancy deteriorates the positive relationship between resource sharing and supply chain performance perception during humanitarian assistance and disaster response operations.	Maghsoudi, 2018 Michelman, 2007 NT	Not supported
Haii Resource redundancy deteriorates the positive relationship between resource sharing and supply chain performance efficiency during humanitarian assistance and disaster response operations.	Maghsoudi, 2018 Michelman, 2007 NT	Not supported
H5aiii Resource redundancy deteriorates the positive relationship between resource sharing and supply chain performance effectiveness during humanitarian assistance and disaster response operations.	Maghsoudi, 2018 Michelman, 2007 NT	Not supported
H5aiv Resource redundancy deteriorates the positive relationship between resource sharing and supply chain performance agility during humanitarian assistance and disaster response operations.	Maghsoudi, 2018 Michelman, 2007 NT	Not supported
H5bi Resource redundancy deteriorates the positive relationship between standardization of operations and supply chain performance perception during humanitarian assistance and disaster response operations.	Maghsoudi, 2018 Michelman, 2007 Contingency Theory (CT)	Supported
H5bii Resource redundancy deteriorates the positive relationship between standardization of operations and supply chain performance efficiency during humanitarian assistance and disaster response operations.	Maghsoudi, 2018 Michelman, 2007 CT	Supported
H5biii Resource redundancy deteriorates the positive relationship between standardization of operations and supply chain performance effectiveness during humanitarian assistance and disaster response operations.	Maghsoudi, 2018 Michelman, 2007 CT	Supported
H5biv.4Resource redundancy deteriorates the positive relationship between standardization of operations and supply chain performance agility during humanitarian assistance and disaster response operations.	Maghsoudi, 2018 Michelman, 2007 CT	Not supported
H5ci Resource redundancy deteriorates the positive relationship between joint logistics effort and supply chain performance perception during humanitarian assistance and disaster response operations.	Maghsoudi, 2018 Michelman, 2007 CT	Not supported
H5cii Resource redundancy deteriorates the positive relationship between joint logistics effort and supply chain performance efficiency during humanitarian assistance and disaster response operations.	Maghsoudi, 2018 Michelman, 2007 CT	Not supported
H5ciii Resource redundancy deteriorates the positive relationship between joint logistics effort and supply chain performance effectiveness during humanitarian assistance and disaster response operations.	Maghsoudi, 2018 Michelman, 2007 CT	Not supported
H5civ Resource redundancy deteriorates the positive relationship between joint logistics effort and supply chain performance agility during humanitarian assistance and disaster response operations.	Maghsoudi, 2018 Michelman, 2007 CT	Not supported
H5di Resource redundancy deteriorates the positive relationship between postponement and supply chain performance during humanitarian assistance and disaster response operations.	Maghsoudi, 2018 Michelman, 2007 CT	Not supported
H5dii Resource redundancy deteriorates the positive relationship between postponement and supply chain performance efficiency during humanitarian assistance and disaster response operations.	Maghsoudi, 2018 Michelman, 2007 CT	Not supported
H5diii Resource redundancy deteriorates the positive relationship between postponement and supply chain performance effectiveness during humanitarian assistance and disaster response operations.	Maghsoudi, 2018 Michelman, 2007 CT	Not supported
H5div Resource redundancy deteriorates the positive relationship between postponement and supply chain performance agility during humanitarian assistance and disaster response operations.	Maghsoudi, 2018 Michelman, 2007 CT	Not supported

Table 8

Hypotheses Part 2: Resource Scarcity as a Moderator

Hypotheses Part 3	Construct/ Citation	Supported/ Not supported
H6ai Resource scarcity deteriorates the positive relationship between resource sharing and supply chain performance perception during humanitarian assistance and disaster response operations.	Maghsoudi, 2018 Michelman, 2007 Agency Theory (AT)	Not supported
H6aii Resource scarcity deteriorates the positive relationship between resource sharing and supply chain performance efficiency during humanitarian assistance and disaster response operations.	Maghsoudi, 2018 Michelman, 2007 AT	Not supported
H6aiii Resource scarcity deteriorates the positive relationship between resource sharing and supply chain performance effectiveness during humanitarian assistance and disaster response operations.	Maghsoudi, 2018 Michelman, 2007 AT	Not supported
H6aiv Resource scarcity deteriorates the positive relationship between resource sharing and supply chain performance agility during humanitarian assistance and disaster response operations.	Maghsoudi, 2018 Michelman, 2007 AT	Not supported
H6bi Resource scarcity deteriorates the positive relationship between standardization of operations supply chain performance perception during humanitarian assistance and disaster response operations.	Maghsoudi, 2018 Michelman, 2007 AT	Not supported
H6bii Resource scarcity deteriorates the positive relationship between standardization of operations supply chain performance efficiency during humanitarian assistance and disaster response operations.	Maghsoudi, 2018 Michelman, 2007 CT	Not supported
H6biii Resource scarcity deteriorates the positive relationship between standardization of operations supply chain performance effectiveness during humanitarian assistance and disaster response operations.	Maghsoudi, 2018 Michelman, 2007 CT	Not supported
H6biv Resource scarcity deteriorates the positive relationship between standardization of operations supply chain performance agility during humanitarian assistance and disaster response operations.	Maghsoudi, 2018 Michelman, 2007 CT	Not supported
H6ci Resource scarcity deteriorates the positive relationship between joint logistics effort and supply chain performance perception during humanitarian assistance and disaster response operations.	Maghsoudi, 2018 Michelman, 2007 CT	Not supported
H6cii Resource scarcity deteriorates the positive relationship between joint logistics effort and supply chain performance efficiency during humanitarian assistance and disaster response operations.	Maghsoudi, 2018 Michelman, 2007 CT	Not supported
H6ciii Resource scarcity deteriorates the positive relationship between joint logistics effort and supply chain performance effectiveness during humanitarian assistance and disaster response operations.	Maghsoudi, 2018 Michelman, 2007 CT	Not supported
H6civ Resource scarcity deteriorates the positive relationship between joint logistics effort and supply chain performance agility during humanitarian assistance and disaster response operations.	Maghsoudi, 2018 Michelman, 2007 CT	Not supported
H6di Resource scarcity deteriorates the positive relationship between postponement and supply chain performance perception during humanitarian assistance and disaster response operations.	Maghsoudi, 2018 Michelman, 2007 CT	Not supported
H6dii Resource scarcity deteriorates the positive relationship between postponement and supply chain performance efficiency during humanitarian assistance and disaster response operations.	Maghsoudi, 2018 Michelman, 2007 CT	Not supported
H6diii Resource scarcity deteriorates the positive relationship between postponement and supply chain performance effectiveness during humanitarian assistance and disaster response operations.	Maghsoudi, 2018 Michelman, 2007 CT	Not supported
H6div Resource scarcity deteriorates the positive relationship between postponement and supply chain performance agility during humanitarian assistance and disaster response operations.	Maghsoudi, 2018 Michelman, 2007 CT	Not Supported

As I undertook this study, I sought to explore the effects that resource redundancy and resource scarcity has on the performance of a humanitarian supply chain. I confirmed two direct effects and only one moderated relationship as a result of my study. With this data set, I conclude that resource sharing had no direct effect, standardization of operations had a positive direct effect, joint logistics effort had a positive direct effect, and postponement had no statistically significant effect on supply chain performance. Resource redundancy had a negative moderating effect on the relationship between standardization of operations and supply chain performance. In my years of experience overseeing and participating in HA/DR logistics, I observed these phenomena. I can confirm that a military logistician (most respondents) would come to the aforementioned conclusions. Standardizing materiel, processes, and procedures enables the HA/DR supply chain to deliver supplies effectively and efficiently. At the same time, joint logistics effort supports the synchronization of the supply chain among stakeholders. As news viewers saw in the wake of the 2010 Haiti earthquake, too many resources hinder the ability of logisticians to standardize supplies and deliver them to affected populations. A summary and potential implications conclude this dissertation.

VI: LIMITATIONS AND CONTRIBUTIONS

Discussion

In this dissertation, I explored the phenomenon of supply chain management during HA/DR operations. By examining the factors that impact supply chain performance, I can make recommendations that will enhance supply chain performance in future HA/DR operations. I selected this topic due to my over 20 years of experience in HA/DR operations. My first four chapters reviewed the relevant supply chain literature, conceptual frameworks' application to supply chain management, humanitarian supply chain management, comprehensive research model development, data collection process, and the manner and method used to test the hypothesized relationships. I reported the results of the quantitative study in Chapter V. For the final study, I explored the relationship among and between the constructs using linear regression.

This dissertation's research is distinct from previous research in HA/DR supply chain by focusing on military, civilian, and non-governmental organizations, and international organizations' logisticians from the United States, Guatemala, Honduras, and Panama. Previous HA/DR supply chain studies focused on national governments and humanitarian organizations' participation in HA/DR operations. Banomyong et al. (2019) conducted a comprehensive literature review. They explored peer-reviewed articles from 2005 to 2015 and found that the number of publications dramatically decreased by more than 60% through 2015. I aimed to add to the HA/DR supply chain literature by exploring some of the differences in military logisticians responses, and perceptions of HA/DR supply chain performance. As the number of disasters increases, the need for military involvement in HA/DR operations will likely also increase. Therefore, informing

military leaders of potential gaps in HA/DR supply chain will alleviate post-disaster suffering and save lives. As recently as November 2020, U.S. Southern Command conducted search and rescue operations and delivered much-needed humanitarian supplies in Colombia, Guatemala, Honduras, and Panama (U.S. Southern Command, 2020).

I will now discuss hypothesis testing for the main study using the results outlined in Figure 2. H1a, H1b, H1c, and H1d were: If resource sharing increases, then all four dimensions of supply chain performance will increase during HA/DR operations. These hypotheses were not supported by the results. Resource sharing is a critical coordination node in supply chain management operations. Although this was an unexpected result, HA/DR operations involving the military are generally established at the closest practical point to distribute HA/DR supplies. The military's organic transportation capability will place them in areas that may not be easily accessible to other HA/DR actors; therefore, they may not have the ability to share resources with others. H2a, H2b, HBc, and H2d were: If standardization of operations increases, then all four dimensions of supply chain performance will increase during humanitarian assistance and disaster response operations. The data supported H2a, H2b, and H2c, and this was an expected result. As discussed earlier in this dissertation, standardized operations increase efficiency and facilitate the HA/DR supply chain integration. Following HA/DR Sphere Standards and standardizing means of communication also allow other HA/DR actors to integrate their supplies into the overall HA/DR supply chain. Network theory, which depends on the relationship among network members (Chang et al., 2012), explains the standardization of

operations construct. H3a, H3b, H3c, and H3d: If joint logistics effort increases, then all four dimensions of supply chain performance will increase during humanitarian assistance and disaster response operations. The data supported H3a and H3d. Joint logistics effort includes: joint supply forecasting and collaborative transportation and has a positive direct effect on two dimensions of supply chain performance. Military planners de-conflict units' supplies during HA/DR operations. They inform the U.N. cluster system on the kinds/types of supplies they are bringing to the affected area.

H4a, H4b, H4c, and H4d: If postponement increases, then all four dimensions of supply chain performance will increase during humanitarian assistance and disaster response operations. Statistical analysis revealed that these hypotheses were not supported. The concept of postponement may be counterintuitive for an HA/DR operation; however, it is valuable for any operation to ensure the correct supplies are moved to the affected area. It has been my experience that military logisticians will move supplies forward as soon as possible to provide relief to the affected population, so I believe the participants' answers did not support the concept as a positive effect on supply chain performance. Since resource sharing and postponement did not directly affect supply chain performance, there could not be a moderated relationship between resource redundancy or resource scarcity and either of the aforementioned constructs. The data did not support hypotheses H5ai, H5aii, H5aiii, H5aiv, H5biv, H5ci, H5cii, H5ciii, H5civ, H5di, H5dii, H5diii, H5div, H6ai, H6aii, H6aiii, H6aiv, H6bi, H6bii, H6biii, H6biv, H6ci, H6cii, H6ciii, H6civ, H6di, H6dii, H6diii, and H6div. The only moderation hypotheses supported by the data were H5bi, H5bii, and H5biii, which stated: Resource redundancy deteriorates the positive relationship between

standardization of operations and all four dimensions of supply chain performance during humanitarian assistance and disaster response operations. The coefficient was negative, which means that too many resources negatively impact the positive direct effect of standardization of operations on supply chain performance. In my experience during the 2010 Haiti earthquake, military logisticians had to organize redundant resources that were clogging up the Port au Prince Airport to improve delivery times of much-needed supplies to the affected population.

This research contributes to the humanitarian supply chain literature by exploring the relationship between these constructs in a military environment and testing their effects on performance. In addition, the results indicate that resource redundancy can have a negative effect on supply chain performance as it deteriorated the relationship between one of the constructs of interest and supply chain performance. These findings are significant since they help to understand that too many supplies are not always good for supply chain performance. This work makes some important contributions to the HA/DR supply chain knowledge base. Research outcomes are sometimes expected and sometimes unexpected; however, researchers benefit from either outcome since it adds to the body of knowledge of the phenomenon under study. This research supported the importance of managing supplies and information. The hypotheses that were not supported by this research require further empirical research and theoretical justification in future studies.

This work provides an important theoretical and practical contribution; it outlines the negative role of resource redundancy on an HA/DR operation's supply chain performance. From a theoretical standpoint, this dissertation utilizes existing theories

such as resource-based view, contingency theory, agency theory, and network theory to explain the major antecedents and outcomes of supply chain performance. Supported by previous research and attempting to fill the gaps in the existing literature, this research offers valuable insights into HA/DR supply chain performance. It also provides empirical evidence of the potential impact of supply chain disruptions and deteriorated logistics capabilities.

Managers and military leaders should consider developing knowledge by developing a framework that incorporates "lessons learned" so they do not become "lessons observed." Incorporating these lessons can help create a resilient HA/DR supply chain ready to deliver and distribute supplies immediately following their arrival at a disaster zone.

Implications

I used the scientific method to confirm or deny some of the suspicions I had anecdotally experienced during HA/DR operations. I confirmed my principal unscientific hunch that too many or redundant resources can deteriorate supply chain performance. Due to this finding, I can discuss procedures and processes that can be changed to prevent this onslaught of supplies that clogs the supply chain at the disaster location. In my experience, this supply excess was not caused by U.S. government supplies; it resulted when military logisticians were asked to merge their relief supply chain with other HA/DR actors. In addition, the concept of resource redundancy was not only referring to materiel, it was also referring to personnel and information resources. Too many people with little or no logistics training can also cause a negative effect on the supply chain. I have personally experienced this phenomenon when too many untrained people want to

help. The time it takes trained logisticians to explain the process to an untrained person can be better used by logisticians to support relief operations. Finally, too much unverified information can wreak havoc on an HA/DR supply chain and disrupt relief delivery. Rumors and unverified information sometimes caused supplies to be diverted to areas that were not in dire need of immediate relief. In summary, too much of anything can disrupt the best well-established processes.

Military leaders must have a representative at the U.N. logistics cluster that meets at the disaster location for the reasons mentioned above. These meetings are an opportunity to exchange information with other HA/DR actors regarding incoming supplies, transportations, personnel shortfalls, or other issues that impact supply chain performance. Anecdotally, I am aware of military leaders who see the U.N. cluster system as a waste of time; however, that is a naïve sentiment that can slow down relief and prolong human suffering. The U.S. Agency for International Development provides a Joint Humanitarian Operations course (JHOC) available to military units to fill this information gap. I recommend that all senior personnel in deployable units attend the JHOC course. In addition, logisticians must ensure they use all of the tools at their disposal by requesting radio frequency identification (RFID).

Limitations

All research methods and designs have flaws and limitations. The limitations of this research include: (a) the relatively small sample size, (b) rules associated with survey distribution, (c) the narrow population targeted to obtain the sample, (d) constraints related to the scope of the study, and (e) the depth of collected information from self-reported measures collected from single informant representatives of each participating

organization. Another limitation of this study is that investigation of the phenomenon of HA/DR supply chain performance is limited to a point-in-time assessment. Designing a longitudinal study could capture the dynamic nature of organizational cultures and the urgency of the situation during the response phase. The U.S. military routinely asks its members to complete online surveys during their contingency deployments. It would be interesting to explore how a group of respondent's answers to a survey change with time during an HA/DR deployment.

The opportunities for further research are many. Extensions of this research could incorporate several contextual directions. For example, HA/DR supply chain performance could be studied with a broader and larger sample size, including some North Atlantic Treaty Organization member nations that routinely participate in HA/DR operations. As commercial and non-HA/DR supply chain risks increase (e.g., COVID-19 pandemic), organizations need to develop resilient logistics processes.

This research generates multiple questions that could be answered in the future. For example, some research questions might be:

1) Could additional variables be included in the proposed framework? What are some of the other potential moderators of the relationships between the independent variables and supply chain performance?
2) Could a direct link between supply chain performance and resource scarcity be established?
3) Could the results of this research be replicated under different contextual conditions, such as broader international settings?

Conclusion

With this research, I explored a phenomenon that has always interested me and one in which I have first-hand knowledge: military supply chain performance during HA/DR operations. The results of this study have enabled me to reinforce existing logistics standards with military HA/DR participants. I have pointed to my results and emphasized the importance of following standardized processes and procedures (standardization of operations) and ensuring logistics efforts (joint logistics effort) are undertaken in a collaborative manner. The primary purpose of this study was to explore and serve as a stimulus for further research in an area whose improvement or enhancement can save lives. In addition to offering a way ahead for further investigation, it provides military and civilian organizations with valuable information and a framework to begin future research. I made empirically-based recommendations and laid the foundation for further study.

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APPENDIX

INFORMATIONAL LETTER

Factors Impacting U.S. Military Supply Chain Performance During Humanitarian Assistance/Disaster Response (HA/DR) Operations

Hello, my name is Walter Diaz. You have been chosen to be in a research study exploring Factors Impacting U.S. Military Supply Chain Performance During Humanitarian Assistance/Disaster Response (HA/DR) Operations. The purpose of this study is to determine the factor that impact supply chain performance during HA/DR operations. Results will help provide insights for supply chain enhancements. Participation in this study will take 5-10 minutes of your time. If you agree to be in the study, I will ask you to do the following things:

1. Answer 28 questions responding to "which extent you agree or disagree with" statements related to Supply Chain Management during HA/DR Operations.

2. Answer 3 questions about yourself.

There are no foreseeable risks or benefits to you for participating in this study. It is expected that this study will benefit society by providing insights and information used to enhance supply chain performance during HA/DR operations. There is no cost or payment to you. If you have questions while taking part, please contact me and ask. Your answers are confidential. If you have questions for one of the researchers conducting this study, you may contact Walter Diaz at 305-323-2256. If you would like to talk with someone about your rights of being a subject in this research study or about ethical issues with this research study, you may contact the FIU Office of Research Integrity by phone at 305-348-2494 or by email at ori@fiu.edu. Your participation in this research is voluntary, and you will not be penalized or lose benefits if you refuse to participate or decide to stop. You may keep a copy of this form for your records.

Do you want to continue this survey?

- ○ YES
- ○ NO

PLEASE CLICK ON THE BLUE ARROW TO ADVANCE THROUGH THE SURVEY

Military Are you a member of the Armed Forces?

- ○ Yes
- ○ No

Skip To: Branch If Are you a member of the Armed Forces? = Yes

Skip To: Org If Are you a member of the Armed Forces? = No

Branch What branch of the Military you belong to?

- ○ U.S. Army
- ○ U.S. Navy
- ○ U.S. Air Force
- ○ U.S. Marines
- ○ U.S Space Force
- ○ Non-U.S. Military (any branch of service)

Org What organization do you belong to?

- ○ U.S. Africa Command
- ○ U.S. Central Command
- ○ U.S. Pacific Command
- ○ U.S. Southern Command
- ○ U.S. Department of State
- ○ U.S. Agency for International Development
- ○ Defense Health Agency
- ○ Defense Logistics Agency
- ○ The Joint Staff
- ○ Non-Governmental Organization
- ○ Non-U.S. Organization

RSS1 Our organization shares lessons learned with other HA/DR actors at the disaster location.

- ○ Strongly disagree
- ○ Somewhat disagree
- ○ Neither agree nor disagree
- ○ Somewhat agree
- ○ Strongly agree

RSS2 Our organization shares information with affected local communities to assess their needs.

- ○ Strongly disagree
- ○ Somewhat disagree
- ○ Neither agree nor disagree
- ○ Somewhat agree
- ○ Strongly agree

RSS3 Our organization shares its logistics infrastructure (personnel and materiel) with other HA/DR actors.

- ○ Strongly disagree
- ○ Somewhat disagree
- ○ Neither agree nor disagree
- ○ Somewhat agree
- ○ Strongly agree

RSS4 Our organization shares affected community assessment information with other HA/DR actors.

- ○ Strongly disagree
- ○ Somewhat disagree
- ○ Neither agree nor disagree
- ○ Somewhat agree
- ○ Strongly agree

RSS5 Our organization shares its supplies with other HA/DR actors.

- ○ Strongly disagree
- ○ Somewhat disagree
- ○ Neither agree nor disagree
- ○ Somewhat agree
- ○ Strongly agree

SOP1 Our organization uses a standard coordination plan for disaster relief.

- ○ Strongly disagree
- ○ Somewhat disagree
- ○ Neither agree nor disagree
- ○ Somewhat agree
- ○ Strongly agree

SOP2 Our organization uses internationally accepted 'Sphere Project' HA/DR standards.

- ○ Strongly disagree
- ○ Somewhat disagree
- ○ Neither agree nor disagree
- ○ Somewhat agree
- ○ Strongly agree

SOP3 Our organization supports the standardization of means of communication.

- ○ Strongly disagree
- ○ Somewhat disagree
- ○ Neither agree nor disagree
- ○ Somewhat agree
- ○ Strongly agree

SOP4 Our organization supports the standardization of information.

- ○ Strongly disagree
- ○ Somewhat disagree
- ○ Neither agree nor disagree
- ○ Somewhat agree
- ○ Strongly agree

SOP5 Our organization uses standardized processes during HA/DR operations.

- ○ Strongly disagree
- ○ Somewhat disagree
- ○ Neither agree nor disagree
- ○ Somewhat agree
- ○ Strongly agree

POS1 Our organization delays ordering additional aid supplies until community needs are assessed.

- ○ Strongly disagree
- ○ Somewhat disagree
- ○ Neither agree nor disagree
- ○ Somewhat agree
- ○ Strongly agree
- ○

POS2 Our organization supports postponing the deployment of additional personnel until requested by responding units.

- ○ Strongly disagree
- ○ Somewhat disagree
- ○ Neither agree nor disagree
- ○ Somewhat agree
- ○ Strongly agree

POS3 Our organization pools and holds unlabeled aid supplies until the call for their requirement comes.

- ○ Strongly disagree
- ○ Somewhat disagree
- ○ Neither agree nor disagree
- ○ Somewhat agree
- ○ Strongly agree

POS4 Our organization supports postponing the deployment of additional personnel until response units request them.

- ○ Strongly disagree
- ○ Somewhat disagree
- ○ Neither agree nor disagree
- ○ Somewhat agree
- ○ Strongly agree

JLE1 Our organization supports the use of collaborative transportation.

- ○ Strongly disagree
- ○ Somewhat disagree
- ○ Neither agree nor disagree
- ○ Somewhat agree
- ○ Strongly agree

JLE2 Our organization conducts joint forecasts of aid supply replenishment with other HA/DR actors.

- ○ Strongly disagree
- ○ Somewhat disagree
- ○ Neither agree nor disagree
- ○ Somewhat agree
- ○ Strongly agree

JLE3 Our organization conducts joint forecasts of aid supply inventory with other HA/DR actors.

- ○ Strongly disagree
- ○ Somewhat disagree
- ○ Neither agree nor disagree
- ○ Somewhat agree
- ○ Strongly agree

JLE4 Our organization shares supply stock level information with other HA/DR actors

- ○ Strongly disagree
- ○ Somewhat disagree
- ○ Neither agree nor disagree
- ○ Somewhat agree
- ○ Strongly agree

RSC1 Lack of supplies at the relief location?

- ○ Extremely unlikely
- ○ Somewhat unlikely
- ○ Neither likely nor unlikely
- ○ Somewhat likely
- ○ Extremely likely

RSC2 Lack of professional logisticians at the relief location?

- ○ Extremely unlikely
- ○ Somewhat unlikely
- ○ Neither likely nor unlikely
- ○ Somewhat likely
- ○ Extremely likely

RSC3 Lack of availability of local warehouses to store supplies in disaster-prone areas?

- ○ Extremely unlikely
- ○ Somewhat unlikely
- ○ Neither likely nor unlikely
- ○ Somewhat likely
- ○ Extremely likely

RRE1 Redundant logistics personnel specialties at the relief location?

- ○ Extremely unlikely
- ○ Somewhat unlikely
- ○ Neither likely nor unlikely
- ○ Somewhat likely
- ○ Extremely likely

RRE2 Redundant efforts in administrative aspects of humanitarian relief?

- ○ Extremely unlikely
- ○ Somewhat unlikely
- ○ Neither likely nor unlikely
- ○ Somewhat likely
- ○ Extremely likely

RRE3 Redundant aid supplies provided by several actors with similar products?

- ○ Extremely unlikely
- ○ Somewhat unlikely
- ○ Neither likely nor unlikely
- ○ Somewhat likely
- ○ Extremely likely

MRK2-1 My organization's leadership is actively supporting process improvement activities.

- ○ Strongly disagree
- ○ Somewhat disagree
- ○ Neither agree nor disagree
- ○ Somewhat agree
- ○ Strongly agree

MRK2-2 My organization's leadership accepts responsibility for process improvement.

- ○ Strongly disagree
- ○ Somewhat disagree
- ○ Neither agree nor disagree
- ○ Somewhat agree
- ○ Strongly agree

MRK2-3 My organization's leadership is actively participating in process improvement activities.

- ○ Strongly disagree
- ○ Somewhat disagree
- ○ Neither agree nor disagree
- ○ Somewhat agree
- ○ Strongly agree

MRK2-4 My organization's leadership often discusses process improvement activities in senior leadership meetings.

- ○ Strongly disagree
- ○ Somewhat disagree
- ○ Neither agree nor disagree
- ○ Somewhat agree
- ○ Strongly agree

RME1 Our organization delivers aid to the required disaster location on time.

- ○ Never
- ○ Rarely
- ○ Sometimes
- ○ Often
- ○ Always

RME2 Our organization dispenses aid to affected population on time.

- ○ Never
- ○ Rarely
- ○ Sometimes
- ○ Often
- ○ Always

RME3 Our organization dispenses aid within the assigned budget.

- ○ Never
- ○ Rarely
- ○ Sometimes
- ○ Often
- ○ Always

RME4 Our organization dispenses aid by efficiently using assigned personnel.

- ○ Never
- ○ Rarely
- ○ Sometimes
- ○ Often
- ○ Always

RME5 Our organization establishes reorder levels to ensure aid is available as required.

- ○ Never
- ○ Rarely
- ○ Sometimes
- ○ Often
- ○ Always

OPM1 Our organization cross leveled supplies with other HA/DR actors.

- ○ Never
- ○ Rarely
- ○ Sometimes
- ○ Often
- ○ Always

OPM2 Our organization achieved its target fill rate.

- ○ Never
- ○ Rarely
- ○ Sometimes
- ○ Often
- ○ Always

OPM3 Our organization provided stock capacity soon after arrival at the disaster location.

- ○ Never
- ○ Rarely
- ○ Sometimes
- ○ Often
- ○ Always

OPM4 Our organization provided a consistent amount of relief supplies.

- ○ Never
- ○ Rarely
- ○ Sometimes
- ○ Often
- ○ Always

OPM5 Our organization met minimum response time (i.e. time between occurrence and arrival at disaster location).

- ○ Never
- ○ Rarely
- ○ Sometimes
- ○ Often
- ○ Always

FLM1 Our organization quickly provided different types of aid supply to the affected population.

- ○ Never
- ○ Rarely
- ○ Sometimes
- ○ Often
- ○ Always

FLM2 Our organization contacted different suppliers simultaneously.

- ○ Never
- ○ Rarely
- ○ Sometimes
- ○ Often
- ○ Always

FLM3 Our organization quickly changed the output level.

- ○ Never
- ○ Rarely
- ○ Sometimes
- ○ Often
- ○ Always

FLM4 Our organization adapted dispensing aid times to local needs.

- ○ Never
- ○ Rarely
- ○ Sometimes
- ○ Often
- ○ Always

FLM5 Our organization integrated new relief items to the aid supply chain.

- ○ Never
- ○ Rarely
- ○ Sometimes
- ○ Often
- ○ Always

SCI1 Our organization's supplies consistently arrived on time.

- ○ Strongly disagree
- ○ Somewhat disagree
- ○ Neither agree nor disagree
- ○ Somewhat agree
- ○ Strongly agree

SCI2 Our organization adjusted to changes in relief supply requirements.

- ○ Strongly disagree
- ○ Somewhat disagree
- ○ Neither agree nor disagree
- ○ Somewhat agree
- ○ Strongly agree

SCI3 Our organization supported the mission within the assigned budget.

- ○ Strongly disagree
- ○ Somewhat disagree
- ○ Neither agree nor disagree
- ○ Somewhat agree
- ○ Strongly agree

SCI4 Our organization did not run out of humanitarian supplies.

- ○ Strongly disagree
- ○ Somewhat disagree
- ○ Neither agree nor disagree
- ○ Somewhat agree
- ○ Strongly agree

SCI5 Our organization supported the mission without requesting additional personnel.

- ○ Strongly disagree
- ○ Somewhat disagree
- ○ Neither agree nor disagree
- ○ Somewhat agree
- ○ Strongly agree

Gender What is your gender?

- ○ Male
- ○ Female

Age What is your age?

- ○ 19 - 25
- ○ 26 -35
- ○ 36 - 45
- ○ 46 - 55
- ○ Over 55

Exp Hum How many years of humanitarian assistance experience do you have?

- ○ 0 to 2
- ○ 2 to 5
- ○ 5 to 7
- ○ 7 to 10
- ○ Over 10

Country What is your country of origin?

- ○ Guatemala
- ○ Honduras
- ○ Panama
- ○ United States of America

Edu_Degree Please select your level of education.

- ○ High School (1)
- ○ Associate's Degree (2)
- ○ Bachelor's Degree (3)
- ○ Master's Degree (4)
- ○ Doctorate or Professional Degree (5)

Edu_SCM Please select the logistics course you attended (if any)

- ○ Army Logistics Specialist
- ○ Logistics Captains Career Course
- ○ Multinational Logistics, an Airman's View
- ○ Theater Logistics, an Airman's View
- ○ Navy Logistics Specialist
- ○ Navy Supply Basic Qualification Course
- ○ United Nations Logistics Course
- ○ Graduate Logistics Certificate
- ○ I attended a logistics course not listed above
- ○ I did not attend a logistics course

VITA

WALTER ISMAEL DIAZ

Born, San Juan, Puerto Rico

1977-1982	B.S., Chemistry University of Puerto Rico Rio Piedras, Puerto Rico
1983-2005	United States Air Force Lieutenant Colonel (Retired)
1991-1992	M.S., Human Resources Management Troy University Montgomery Montgomery, Alabama
1992-1993	M.B.A. Auburn University Montgomery Montgomery, Alabama
2005-Present	Deputy Command Surgeon U.S. Southern Command Miami, FL
2011	Certificate in Logistics and Technology University of North Carolina Chapel Hill, North Carolina
2012	Certificate in Supply Chain Management Pennsylvania State University State College, Pennsylvania
2020-2021	Doctoral Candidate Florida International University Miami, Florida

PUBLICATIONS AND PRESENTATIONS

Diaz, W. I., (2015). *Ebola Virus Disease Preparation in the Americas: A Whole of Society Approach.* International Committee on Military Medicine, World Congress, Bali, Indonesia.

Diaz, W. I., (2015). *Ebola Virus Disease Preparation in the Americas: A Whole of Society Approach.* Global Health Security of the Americas Conference, Lima, Peru.

Diaz, W. I., Diz, M., Litano, L., Phillips, S. (2020). *Global Effects of Blockchain: Retrospective data analysis of emergent utilization,* Academy of International Business, 10th Annual Congress. Latin American and Caribbean Chapter, Interactive Session.