



**ALIGNING PERFORMANCE MANAGEMENT SYSTEMS FOR LASTING
OUTCOMES IN HUMANITARIAN ORGANIZATIONS**

DISSERTATION

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AFIT-ENS-DS-20-S-044

**DEPARTMENT OF THE AIR FORCE
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OUTCOMES IN HUMANITARIAN ORGANIZATIONS

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Abstract

Logistics is dynamic, expansive, and critical to organizational success. While it is generally believed that effective logistics management is associated with positive performance outcomes, the links between organizational practice and performance are understudied. This dissertation leverages resource-based theory and organizational learning theory to examine organizational practice and performance in non-traditional logistics settings, with particular focus on military organizations and humanitarian operational settings. First, a meta-analytical study establishes generalizable associations between various operations management practices and performance outcomes. Then, this is applied to dynamic humanitarian logistics settings, exploring how practitioners perceive practice and performance, and how this is reported and documented for organizational performance improvement. A cumulative case study provides actionable recommendations for humanitarian practitioners and insights into an understudied area of performance management and organizational learning, which are then examined in-depth in a humanitarian field exercise. This dissertation demonstrates the importance of deliberate resource alignment, collaboration and learning for lasting logistics operations management success.

To address these gaps, this dissertation 1) establishes generalizable associations between various organizational practices and performance outcomes; 2) applies this insight to humanitarian logistics settings, exploring how practitioners perceive practice and performance; and 3) examines how these associations are codified for organizational improvement.

To my daughter, may you never stop learning.

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ALIGNING PERFORMANCE MANAGEMENT SYSTEMS FOR LASTING OUTCOMES IN HUMANITARIAN ORGANIZATIONS

I. Introduction

Logistics is a key to operational success for the modern organization. The study of logistics has evolved from physical distribution to include a range of logistics management competencies, to the management of supply chains and inter-organizational relationships, and has been absorbed into the domain of operations management. Logistics is important because it is expansive, expensive, and critical to realizing the desired performance outcomes.

Far-reaching global supply chains are vulnerable to disruptions and subject to high levels of uncertainty and variability. This inherent vulnerability is especially significant in dynamic operating conditions, such as those involved in humanitarian response. These environments draw a multitude of responders, including military organizations, non-governmental organizations, and international humanitarian organizations, and operations are also influenced by the beneficiary population, the assisted state, donor groups, and others. Responding organizations provide a range of expertise and resources, as well as complementary – and competing – goals and objectives, which complicate the response effort and muddle the relationship between an organization's practice and performance outcomes.

Accordingly, relationships between organizational practices and successful performance in these environments is not well understood. Conflicting results dissuade practitioners from implementing operations management practices that could have far-

reaching impacts – preventing loss of life, mitigating human suffering, and safeguarding critical networks and infrastructure. Furthermore, how these relationships are affected by collaboration and learning culture is understudied, leaving practitioners without a clear path to continuous improvement and innovation in support of humanitarian objectives.

1.1 General Issue

Humanitarian operations, much like commercial business, are subject to dynamic and resource-constrained environments. In these settings, organizational leaders must make investment trade-offs with imperfect information regarding future demands and disruptions. Research efforts can clarify how organizational practice impacts performance outcomes, serving to simplify investment decisions, highlight critical competencies, and outline a path for developing a supporting organizational culture.

Performance management systems have not been widely studied in the context of humanitarian operations or disaster relief logistics. Tools and techniques have been adapted from commercial business, with some success, but they fail to adequately address the range of performance outcomes of importance in the humanitarian context.

Existing humanitarian research relies heavily on simulation and modeling methodologies and a few key theories. Borrowing theories and methods from other domains, as is common in logistics research, can provide unique perspectives and insights. When coupled with a holistic view of problem sets and variables, this approach supports the building of generalized knowledge and theory.

1.2 Research Objective

The objective of this research is to provide recommendations for humanitarian practitioners and insight into an understudied area of performance management and organizational learning. Specifically, this research seeks to 1) establish generalizable associations between various logistics operations management practices and performance outcomes; 2) apply this insight to humanitarian logistics settings, exploring how practitioners perceive and report practice and performance; and 3) examine how these practitioner observations are leveraged for organizational improvement and lasting logistics operations success.

1.3 Research Contributions

With regard to the targeted research objectives, this dissertation provides the following contributions:

1. *Establishes generalizable associations between various logistics operations management practices and performance outcomes.* Generalizable insight is lacking for a comprehensive theory of quality management. This study introduces structural equation modeling (SEM)-based meta-analysis to the field of logistics and operations management in order to better address heterogeneity and clarify the relationship between organizational practice and performance outcomes. Under resource-based theory, this study identifies technical, behavioral, and collaborative quality management (QM) practices as key capabilities, essential to the competitive performance of logistics firms. This SEM-based meta-analysis draws from 78 primary studies, representing a wide range of logistics settings and QM philosophies, marking a departure from the traditionally

myopic academic study of these topics. Utilizing various random- and mixed-effects models, support was found for the general relationship. Additional findings indicate that the traditional study of QM practice by philosophical categories may be incorrect, and that the most substantial benefits of QM programs are indirect, not operational, performance outcomes. This study represents a step toward the generalization of knowledge for a comprehensive QM theory and presents practical recommendations and insights for the proper implementation and management of QM programs.

2. *Applies this insight to humanitarian logistics settings, exploring how practitioners perceive practice and performance.* Humanitarian logistics and operations management is subject to exceptional uncertainty, variability, risk, and unique operational challenges that complicate efforts for organizational learning and performance improvement. This cumulative case study examines how humanitarian practitioners perceive organizational practice and performance, and how these perceptions impact codification of lessons learned in support of organizational improvement efforts. The study extends the application of organizational learning theory in this domain, to describe the moderating effect of trust and other factors between a humanitarian organization's resource-based capabilities and performance outcomes. Exploratory interviews with thirteen practitioners and 54 learning documents provide themes and statistical patterns regarding how these topics are included and discussed in reports, demonstrating the effects of trust, bias, organization, document label, and humanitarian setting on organizational learning efforts in humanitarian operations management. Findings demonstrate the potential for improved performance through

employing a variety of learning mechanisms and engaging in collaborative learning networks and partnerships.

3. *Examines how participant observations are codified for organizational improvement.* Humanitarian logistics and operations management is complicated by the changing needs of the disaster response cycle and diverse stakeholder groups, which makes for a complex organizational learning environment. This dissertation extends the application of organizational learning theory in this domain, leveraging a large-scale multinational humanitarian field exercise, participant observation, interviews, and statistical log-linear and proportional analysis to examine the iterative use of a unique collaborative learning tool for innovation performance and lasting performance outcomes. The study explores how organizational practice and performance topics are regarded by participants and how these observations aggregate into learning documents. Findings further our understanding of the gap between individual learning and codification for organizational learning and support varying learning mechanisms and engaging in collaborative learning networks for sustained improvement in humanitarian operations.

1.4 Preview

The remainder of this dissertation follows a scholarly article format. Chapters II, IV, and V are independent research articles on logistics operations and performance management. Each chapter is self-contained in that it contains its own introduction, literature review, methodology, results and analysis, and discussion sections. Additionally, each chapter contains its own future research recommendations.

Chapter II generates cumulative knowledge in support of generalized relationships between an organization's resource-based practices and capabilities and the organization's performance. This chapter also introduces the reader to three categories of performance outcomes – *primary performance outcomes* that are the direct result of logistics and operations management, *secondary performance outcomes* of importance to a variety of internal and external stakeholders, and *innovation performance outcomes* critical to sustained performance and the long-term success of an organization.

Chapter III introduces the reader to the humanitarian operating environment and the unique factors that impact performance management in this setting. These factors include the principles that guide humanitarian actors, the changing operational priorities and challenges over the course of the humanitarian response cycle, and a diverse range of stakeholders. These factors both enrich and complicate humanitarian operations, with implications for performance management and improvement efforts.

Chapter IV examines the generalized insights from Chapter II within the humanitarian context. A cumulative case study draws from practitioner experiences across a 10-year period in the Pacific region, providing insight into factors that moderate practitioner perception of resource-based capabilities and organizational performance. This study also provides insight into the impact of bias, trust, document and organization type, and humanitarian setting on reporting behaviors, with recommendations for improving organizational learning in humanitarian settings through a range of learning mechanisms and collaborative partnerships.

Chapter V provides a unique case study of network learning in the humanitarian operations environment. A military exercise conducted with trilateral partners and

civilian humanitarian practitioners demonstrates how an individual's observations are incorporated into formal reporting, and tests recommendations from the previous study.

The final chapter provides concluding remarks and summarizes the contributions made by each academic paper. Finally, it closes with suggestions for future research.

II. Quality Management Practice and Performance: A Structural Equation Modeling-Based Meta-Analysis

2.1 Introduction

Commercial business defines successful performance as “providing products and services that meet customer expectations at a product delivery cost significantly lower than the perceived value” (Anupindi et al, 2012: 2). Value advantage can be attained by focusing business strategy on product dimensions (cost, delivery time, variety, and quality) and complementary process dimensions (cost, flow time, flexibility, and quality). This strategy necessarily changes over time, as the organization and its environment change. The business cycle demonstrates a historical pattern of recession and expansion, during which time investment and production activities wax and wane according to various trade-off criteria (Silver et al, 1998). Traditionally, trade-offs are determined by a variety of cost factors including unit value, fixed/overhead costs, and short-term insufficiency costs (typically restricted to profit losses – lost sales or customers). Other, non-cost factors include replenishment lead time (linked to the time value of the goods), as well as short-term insufficiency costs.

Many organizations have taken to logistics and operations management in order to improve performance and remain competitive over time. Quality management is one of the most popular of these practices (Ebrahimi and Sadeghi, 2013). The QM movement began in Japan in the 1950s and expanded to the United States and Europe during the 1970s and 1980s with the works of Ishikawa (1972), Deming (1982), and Juran (1986). However, academic research on the topic did not begin in earnest until the 1990s (Nair,

2006). Quality management is now understood to encompass internal and external business processes aimed at the continuous improvement of process, product and service performance to exceed customer expectations (Sousa and Voss, 2002; Prajogo and McDermott, 2005). As such, quality management is now widely considered to be essential for the effective management and competitive survival of organizations (Nair, 2006).

Though academic research is generally supportive of a positive relationship between QM practices and performance, there have been some conflicting results. In one study, Fuchsberg (1993) found that total quality management (TQM) firms did not outperform non-TQM firms. Others have found that some organizations had difficulty with program implementation and investment trade-off decisions (Samson and Terziovski, 1999; Terziovski and Samson, 2000; Rad, 2006). There is a need for a more extensive investigation to clarify details of implementation for practitioners (Ebrahimi and Sadeghi, 2013). These points of conflict generally center on quality management philosophy, performance measures, and operating environment.

Existing studies have attempted to answer questions of which quality management practices are related to various measures of firm performance. Typically, these studies center on one quality management philosophy, such as TQM, just-in-time, six sigma, or lean. However, as many of the organizational practices encouraged by these philosophies, especially managerial and leadership practices, are common between QM approaches, these labels are not distinctive, making the myopic view ineffective (Camisón and Puig-Denia, 2016; Cho et al, 2017). For example, one study found inconsistent lists of practices to describe just-in-time QM programs, sometimes including

only one of ten possible related practices (Mackelprang and Nair, 2010). This current study spans QM philosophies, categorizing the practices instead by technical, behavioral, and collaborative labels. These labels are based off the study on QM evolution by Cho et al (2017) but split behavioral practices along internal/external lines.

Previous studies' operationalizations of performance have been similarly myopic. Although most existing studies have investigated the relationship between various quality management practices and diverse firm performance measures, their emphasis has been on operational or financial performance. Other studies examine other aspects of performance, such as customer focus, supplier relationships, and leadership. Future performance and innovation are rarely considered (Abreu-Ledón et al, 2018).

This study utilizes the performance labels in Ebrahimi and Sadeghi's (2013) – primary and secondary performance – with the addition of a third category: innovation performance. This study can provide a foundation for multi-criteria decision-making models to enable the extension of quality management practices into fields where profit and financial performance are less central to operations and decision-making (e.g., government, military, and not-for-profit organizations) and where diverse stakeholder groups create a wide range of secondary performance objectives (e.g., humanitarian response operations).

Most related research has been conducted in stable manufacturing settings, presenting issues with generalizability and extension to dynamic environments. Location plays a role, as (Abreu-Ledón et al, 2018) found that QM practices are implemented more effectively in emerging economies. Additionally, one common technical practice, quality data analysis, was found to be counterproductive under conditions of high uncertainty or

when there were multiple (often competing or ambiguous) performance objectives. However, these operating conditions are now more common, both due to the globalization of supply chains and the extension of quality management principles to the service sector (March and Olsen, 1976; Daft and Lengel, 1986; Daft et al, 1988; Lord and Maher, 1990; Dean and Bowen, 1994). Additionally, these general insights may prove more useful in large, global organizations, where operating environments are more diverse.

The present study examines the relationship between quality management practice and organizational performance in pursuit of generalized findings that can be applied across a wide variety of organizations and settings. Utilizing categories of practice and performance, provides insight into these general relationships, leading to recommendations for practitioner action and insights for future study and theorizing.

RQ. What generalizable relationships exist between quality management practice and organizational performance?

To this end, this paper utilizes SEM-based meta-analysis. This meta-analytic method is better able to evaluate and address sample heterogeneity than traditional methods. This is paramount in our dealing with diverse practice, performance outcomes, and operating environments. In general, meta-analysis and related methods are used extensively in medical fields but have been underutilized in logistics and supply chain management, generally due to a lack of comparable empirical studies (Durach et al, 2017). While some related QM studies utilize meta-analysis, application of the SEM-

based method permits the generalization results across a broader context, providing more reliable insights for practitioners and academics.

Accordingly, the primary contributions of this study are twofold: (1) generating cumulative evidence to clarify the relationship between organizational quality management practice and performance, and (2) introducing SEM-based meta-analysis to this complex logistics and operations management topic. The practice of generating cumulative evidence, though common in medical fields, is not prevalent in logistics; this approach clarifies results both for managers, to make better-informed implementation decisions, and for academics, in the pursuit of a generalizable and robust theory of quality management that cuts across diverse operational settings, quality management philosophies, and performance outcomes of interest.

The rest of this paper consists of literature review, methodology, results and analysis, and discussion.

2.2 Literature Review

Founded in resource-based (view) theory (RBT), this study positions organizational practices as unique resources and capabilities that provide for desired performance outcomes, individually, and in the form of combinative capabilities supporting organizational growth and sustained advantage. Quality management practices, organizational performance, and their relationship, has been studied within logistics and operations management research streams, although only in segments. Practices are studied primarily within a certain philosophy or approach and performance is studied with myriad measures, but generally focus on operational or financial

performance. As a result, the conclusions of individual studies regarding the relationships that exist between organizational practice and performance are correspondingly limited.

2.2.1 Theoretical Background

Originally conceptualized by Penrose (1959), RBT posits that firms control resources that enable the conception and implementation of strategies that improve efficiency and effectiveness (Daft, 1983) while generating a sustained competitive advantage (Barney, 1991). Restated with customer focus, a firm must seek to satisfy its customers by providing a greater value than its competitors (Porter, 1985), which manifests either as a focus on performance results (e.g., competitiveness and profit) or as a focus on determinants (e.g., quality, flexibility, resource utilization, and innovation).

The resource base of a firm consists of a collection of resources, assets and capabilities that are within the scope of the organization's control and are owned or accessible on a semi-permanent basis (Wernerfelt, 1984; Kogut and Zander, 1992). A resource may be deemed valuable if it is rare, inimitable, and non-substitutable and if the resource contributes to a competitive advantage (Barney, 1991). These resources may be tangible or intangible, belonging to one of three categories – physical capital, human capital, and organizational capital resources (Becker, 1964; Tomer, 1987). Tangible resources are often highly mobile, able to be copied by other firms, resulting in a short-lived competitive advantage. Conversely, intangible resources are more difficult to imitate or substitute, providing longer sustained benefits (Becker, 1964). Firms may also leverage unique resources in the form of combinative capabilities, defined as the ability

of a firm to synthesize and apply current and acquired knowledge (Kogut and Zander, 1992).

A firm's resource base cannot provide value indefinitely. Leadership must work to maintain and improve upon these resources in order to be competitive in the long-term (Penrose, 1959). In acknowledgement of this fact, Teece et al (1997) extended RBT to include dynamic capabilities, defined as the ability of firms to integrate, build, or reconfigure internal and external competencies to address changing environments. Dynamic capabilities are the change and learning capabilities of a firm (e.g., through visionary leadership or research and development) to create, extend, or modify the resources at its disposal (Helfat et al, 2007). RBT and dynamic capabilities are used frequently in logistics and supply chain management research. Accordingly, this study takes a wider view of QM practices within the resource-based view of the firm. QM practices are identified as key resources essential to improved performance outcomes, which can be leveraged to provide competitive advantage.

2.2.2 Quality Management Practices

The QM practice constructs vary across primary studies. Some studies derived key quality practices from the teachings of quality gurus and criteria for quality awards such as the Malcolm Baldrige National Quality Award, the Deming Prize, and European Foundation for Quality Managers. Other studies use case studies and descriptive literature to develop constructs, while others use measurement instruments (Hietschold et al, 2014). In a review of 145 studies, Hietschold et al (2014) reported 64 unique instruments. This study applies multiple operationism, wherein many measures with a shared conceptual definition and different patterns of irrelevant components are leveraged

to build a comprehensive definition (Webb et al, 1981). Use of varied operationalizations can substantiate findings, confirming propositions by way of multiple independent measures, which serve to minimize errors in interpretation. Adding to conceptual breadth improves the robustness of the results (Cooper, 1998).

Our study expands on three related meta-analyses (Nair, 2006; Mackelprang and Nair, 2010; Abreu-Ledón et al, 2018). However, these studies do not use SEM-based methods, nor do they possess a similar breadth. These studies look at TQM, just-in-time, and lean practices (respectively) and various performance outcomes, described in Table 1. Additionally, innovation performance is not examined in these meta-analyses, except in Abreu-Ledón et al's (2018) consideration of future performance, defined as measures that show future value creation. Table 1 provides a summary of secondary studies. Additionally, several systematic literature reviews build a foundation for the field's understanding of quality management practices.

The systematic literature conducted by Ebrahimi and Sadeghi (2013) indicated that despite inconsistencies across empirical studies, effective quality management implementation led to significant performance improvements. This study extracted 224 unique quality management practices reported in the literature and identified seven key practices: human resource management, customer focus/satisfaction, top management commitment and leadership, process management, supplier quality management, quality information and analysis, and strategic quality planning. In the Hietschold et al (2014) review of 145 publications, eleven distinct dimensions emerged – human resource management/recognition/ teamwork, top management commitment and leadership, process management, customer focus and satisfaction, supplier partnership, training and

learning, information/analysis/ data, strategic quality planning, culture and communication, benchmarking, social and environmental responsibility. Innovation and resources were also frequently reported in the literature but did not meet the study's criteria for inclusion as critical success factors.

Table 1. Meta-Analysis Secondary Studies

Study	Primary Studies	Practice	Performance
Nair (2006)	23 (1995-2004)	TQM (Management leadership, people management, process management, product design and management, quality data analysis, supplier quality management, customer focus)	Financial, operational, customer service and product quality
Mackelprang & Nair (2010)	25 (1992-2008)	Just-in-time (Setup time reduction, small lot sizes, supplier deliveries, daily schedule adherence, preventative maintenance, equipment layout, Kanban, customer link, pull system, repetitive master schedule)	Quality, inventory management, manufacturing cost, cycle time, manufacturing flexibility, delivery
Abreu-Ledón, Luján-García, Garrido-Vega & Escobar-Pérez (2018)	30 (2000-2016)	Lean (Process control and improvement, just-in-time flow, workforce development, maintenance management, customer focus, supplier relationships)	Financial, market/customer, process, people development, future
*Current Study	78 (1992-2017)	Technical, behavioral, collaborative	Primary, secondary, innovation

Thus, the general model is hypothesized:

H1. Quality management practices are positively associated with organizational performance.

Camisón and Puig-Denia (2016) asserted that quality management practices are categorized in the literature in a manner that is fragmented and unsystematic. A review of the literature clearly indicates that QM practices have been classified in many ways – infrastructure and core (Flynn et al, 1995), tangible and intangible (Powell, 1995), people and tool (Dow et al, 1999), soft and hard (Dubey and Gunasekaran, 2015). Labels such as TQM fail to uniquely designate a specific managerial practice or set of practices, and these practices are also employed in other QM philosophies. The practices included in an organization's quality management system are highly variable, hybrid forms of multiple philosophical labels. Successful organizational performance is dependent upon successful implementation of a certain mix of practices (Danese et al, 2012).

This study employs the language by Cho et al (2017), splitting QM practices into technical and behavioral categories. The category of technical QM practices consists of data-oriented, tangible and technology-driven practices related to operations or process management. These specific practices are generally derived from a particular QM philosophy, often as a series of tasks for managers to employ toward the goal of improved performance, such as international quality standards (e.g., International Organization for Standardization, ISO, 9000), just-in-time, total productive maintenance, lean, six sigma, value stream mapping, and continuous process improvement philosophies. This category of practice also includes many practices that are generally considered *logistics*, to include inventory management practices. Behavioral QM practices include 'human-oriented, intangible, and relationship-driven practices' (Cho et al, 2017). These practices are related to organizational culture, human resource management, leadership and orientation. These characteristics are present in most

contemporary management philosophies. Samson and Terziovski (1999) found evidence that behavioral practices explain more variation in performance than the core (technical) QM practices.

Furthermore, behavioral QM practices may be more accurately studied by separating those behavioral practices that are internal to the organization (e.g., human resource management) from those that are external (e.g., supplier and customer relationships). This is supported by unique research streams related to supply chain management and supply chain integration, as well as the prevalence of customer-focused practices in related literature. One study found customer focus to be the only practice that was significantly correlated with aggregate performance as well as each of four categories of performance – operational performance, customer service, product quality, and financial performance (Nair, 2006). Another went so far as to say that customer focus and relationship management was “the greatest determinant of organization performance” (Pannirselvam and Ferguson, 2001). These QM practices are labelled as collaborative QM practices for the purpose of this study.

Within RBT, an organization’s resources and capabilities may take a variety of forms. Technical practices and capabilities rely on explicit knowledge which can be easily transferred both within the organization and to competitors, resulting in a short-lived competitive advantage and only a small impact on performance. Conversely, intangible resources that rely on the development of tacit knowledge, such as behavioral and collaborative practices, are more difficult to imitate or substitute, providing longer sustained benefits (Becker, 1964; Kogut and Zander, 1992). Behavioral practices have been correlated with significant positive performance outcomes across a wide variety of

markets and cultures (Naor et al, 2008). A recent study found that behavioral QM practices fully mediate the relationship between technical practices and firm performance (Cho et al, 2017).

This study classifies quality management practices into three groups: technical, behavioral, and collaborative, and tests hypotheses on their relationship with firm performance. As each category of practice impacts performance in different ways, the correlations with performance will be of different magnitudes. Thus, the following hypothesis regarding quality management practices:

***H2.** Each category of quality management practices will contribute to firm performance, and that these contributions will be distinct.*

2.2.3 Organizational Performance

Firm performance is a vibrant research area. This systematic literature review reported operational, quality, financial/market, innovation, and customer satisfaction as the most widely cited performance measures. Ebrahimi and Sadeghi (2013) grouped these outcomes by those primary performance measures that follow directly from QM implementation (i.e., operational performance), secondary performance measures that are next-level consequences of successful implementation (e.g., quality, financial, market, and customer satisfaction performance), and a third category of innovation performance measures, which are crucial in sustaining the resultant competitive advantage (Prajogo and Sohal, 2003).

Primary performance encompasses operational performance measures. QM practices have been found to have various internal benefits and improved competitiveness

(Hendricks and Singhal, 1997; Corbett et al, 2005) and improved supply performance (Vanichchinchai and Igel, 2011). Furthermore, Samson and Terziovski (1999) determined that TQM practice intensity explained a significant proportion of the variance in firms' operational performance, especially those QM practices of leadership, management of people, and customer focus. Neely (2007) outlined five main objectives for operational performance: speed (of delivery or research and development), cost (variation of cost-per-unit as a result of volume and sales), flexibility (to meet various demand requirements quickly), dependability (with respect to on-time delivery to customers) and quality (conformation to standards, desirability, reliability, durability, serviceability, as well as perceived value and effectiveness for use). For the purposes of this study, only internal quality measures (such as conformation to internal standards, reliability, durability, and serviceability) are included under primary performance measures.

Secondary performance measures are consequences of a firm's successful implementation of QM practices, such as outcomes related to financial results and market responses, external quality, and customer satisfaction. Neely's (2007) concept of quality was diverse, including conformation to standards as well as the customer-facing notions of desirability, perceived value and effectiveness for use. QM program success, as measured by quality performance, leads to success in other performance measures (Brah et al, 2002). Much of the literature focuses on the positive relationship with financial outcomes such as growth in market share, profitability, and return on assets (Powell, 1995; Hendricks and Singhal, 1997; Kaynak, 2003). A study of firms adopting ISO 9000 series quality standards found that implementation was followed by significant financial

improvements, which were sustained in all cases for over three years (Corbett et al, 2005).

The third performance category, innovation, has been positively linked with quality management practices in literature. Prajogo and Sohal (2006) asserted that TQM, along with technology/research and development management, would strengthen firms' innovation performance. Tools associated with strategic quality management may also drive innovation, creating conditions supportive of creativity, initiating the innovation process, producing innovation content and implementing primary process innovation (Bossink, 2002). Kanji (1996) examined various forms of innovation – product, process, application, system, core competence, and horizontal transfer – and their linkage with TQM using industry cases, asserting that TQM supports customer-centered innovations and the pursuit of business.

In a literature review of TQM and innovation, Prajogo and Sohal (2003) argued that innovation performance is gaining momentum as the basic approach to achieving competitive advantage has changed from quality to innovation. Accordingly, if firms have shifted from quality to innovation, QM practices should increase innovation performance more than other categories of performance. This study made a distinction between product versus process innovation, as well as incremental versus radical change. Most literature was supportive of a positive relationship between TQM practices and innovation, while other studies concluded mixed results. Conflicting results were impacted by factors including narrow focus, risk avoidance, the 'trap' of incremental change/single-loop learning, and the emphasis on formalization and standards. López-Mielgo et al (2009) attempted to reconcile whether quality and innovation management

are conflicting activities, and found that the relationship is positive and bi-directional. Additionally, innovation is sometimes conceptualized as an orientation or a contributing factor, rather than as a performance outcome (Hietschold et al, 2014). The general nature of innovation performance remains unclear. Thus, the following is hypothesized regarding various categories of performance:

***H3.** Quality management practices will be positively associated with each category of organizational performance, and that these associations will be distinct.*

2.3 Methodology

This secondary study employs three SEM-based meta-analytic models. A random-effects model establishes a general relationship, which is explored further through two mixed-effects models, utilizing practice and performance categories. The fixed-effects model is omitted due to its limited generalizability. Figure 1 shows the methodological process for this study.

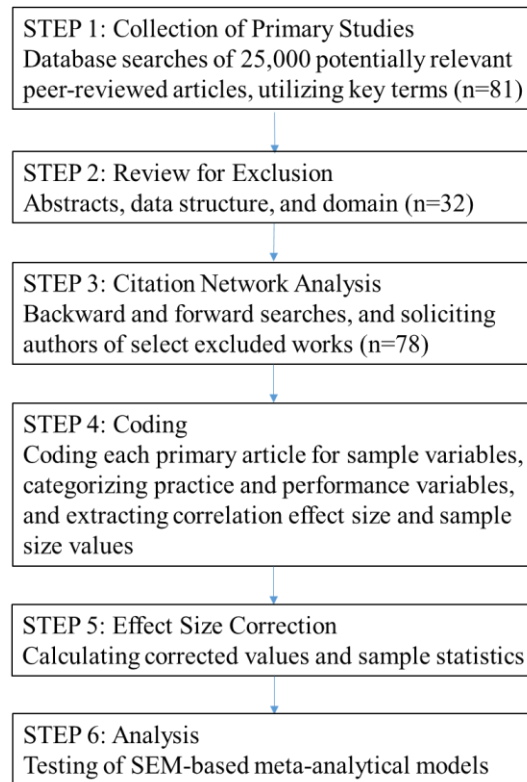


Figure 1. Meta-Analysis Process Flow Diagram

2.3.1 Analysis Method

Glass (1976) defined meta-analysis as the “statistical analysis of a large collection of analysis results from individual studies for the purpose of integrating the findings” (p. 3). Cook and Leviton (1980) built on this definition, adding that, in meta-analytical studies, “summary statistics from each study (e.g., means or correlations) are treated as the units of analysis, and the aggregate data are then analyzed in quantitative tests of the proposition under examination” (445).” These individual study results are then converted to a common metric, “effect size,” and generally adjusted for sample size and variance using a Fisher’s z transformation (Berger, 1983)

Meta-analysis and SEM methods are “usually treated as unrelated topics in the literature” (Cheung, 2008: 183). Meta-analytic structural equation modeling (MASEM)

was briefly mentioned in Hunter and Schmidt (2004) and Cheung and Chan (2005). However, their MASEM combinatorial technique was limited to “combining correlation matrices and covariance matrices. The pooled correlation or covariance matrix is then used to estimate a structural model. It is not intended to synthesize other effect sizes... or the odds ratio” (Cheung, 2008: 183). Conversely, the SEM-based meta-analysis proposed by Cheung (2008) can be formulated as SEM models, used to conduct meta-analysis directly.

One benefit of this approach is that it allows us to assess and quantify effect size heterogeneity and address it through various models. As researchers tend to accept that population effect sizes are heterogeneous, addressing heterogeneity properly is an important issue in meta-analysis (Thompson and Sharp, 1999). Compared to conventional meta-analytical methods, the SEM-based meta-analytical models can provide the benefits of SEM and the simultaneous estimation of fixed and random effects models using the maximum likelihood method (Cheung, 2013).

The primary methodological weakness is the dependency on primary studies. Both in terms of quantity – the availability of multiple prior empirical studies and correlation statistics – as well as quality – primary study design features, reliability and validity. These concerns were overcome through the use of multiple database searches and varying search criteria, which yielded a sufficient body of primary studies. The between-study variance, in terms of research design, method, theoretical foundation, and constructs, serves to triangulate the findings (Denzin, 2006; Nair, 2006). Additionally, the fail-safe N accounts for publication bias (Rosenthal, 1979). The value was exceedingly large (9,561,170) to attenuate any related concerns (Card, 2012).

The fixed-effects model is the simplest model, which involves pooling independent effect sizes without any covariate. This model is appropriate when the effect sizes are homogenous (National Research Council, 1992) or when a researcher is not looking to generalize results outside of the study sample (Hedges and Vevea, 1998). Additionally, fixed-effect models are limited, as these models only address the sample variance. Random-effects models are more appropriate for populations with heterogeneous effect sizes, as this also accounts for between-study variance with samples and methods used across studies. Random-effects models allow inference to be generalized beyond the studies used in the analysis (Hedges and Vevea, 1998). Mixed-effects models also include study-specific covariates, thus combining the fixed and random effects. For the purpose of this study, the fixed model was omitted, due to its limited generalizability.

First, the mathematical form of the random-effects model, using the same mathematical expression of Cheung (2015). Let the true population effect size, β_R , be the mean population effect size in the random-effects model, u_i , be the heterogeneity variance to be estimated, and ε_i be error terms. Then, the observed effect size, y_i , can be expressed as the following:

$$y_i = f_i + \varepsilon_i \quad (1)$$

$$f_i = \beta_R + u_i \quad (2)$$

where u_i is distributed with the mean, zero, and the variance of the true effect sizes, τ^2 , which is theoretically not influenced by the sampling error.

Equations (1) and (2) can be merged:

$$y_i = \beta_R + u_i + \varepsilon_i \quad (3)$$

Equation (3) is rewritten as the following, where v_i is error variance:

$$y_i \sim N(\beta_R, \tau^2 + v_i) \quad (4)$$

Conceptually, the univariate random-effects meta-analytic model becomes a one-factor confirmatory factor analysis model with just one indicator (Cheung, 2015). Figure 2 reveals the graphical representation of the equation (4).

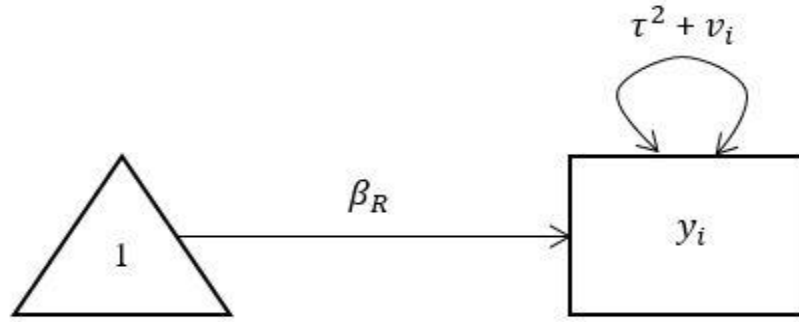


Figure 2. Meta-Analysis Random-Effects Model

The following model implied momentums are fitted for executing the univariate random-effects meta-analysis, where β_R and τ^2 are estimated simultaneously:

$$\mu_i(\theta) = \beta_R \text{ and } \Sigma_i(\theta) = \tau^2 + v_i \quad (5)$$

Second, the mathematical form of the mixed-effects model modifies the random-effects model by including moderators for study characteristics (Cheung, 2015). These moderators can be treated as either variables or design matrices (Cheung, 2013). In this study the mixed-effects model that treats the moderators as the variables is reviewed.

The equation for the observed effect size is the same as in equation (1). The true population effect size is defined as the following:

$$f_i = \beta_0 + \beta_1 x_i + u_i \quad (6)$$

Figure 3 shows the mixed-effects model that treats the moderators as the variables.

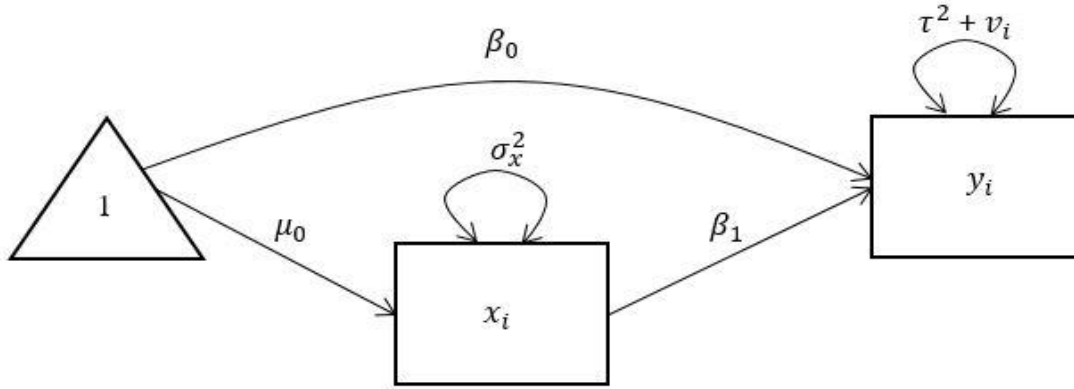


Figure 3. Meta-Analysis Mixed-Effects Model

Similar to the equation (5), the following two moments are fitted:

$$\mu_i(\theta|x_i) = x_i^T \beta \text{ and } \sum_i (\theta|x_i) = \tau^2 + v_i \quad (7)$$

The metaSEM package (Cheung, 2015) in R was used for fitting two momentums in each model (R Core Team, 2018).

2.3.2 Data Collection

After having defined the research objectives and scope, a systematic literature review search was performed in EBSCOhost and Google Scholar to obtain the relevant

empirical studies. The full text, abstract, and keywords of articles were searched for four main sets of terms: at least one of [logistics or supply chain], [improvement or quality], [performance] and [correlation, meta-analysis, or SEM]. In December 2017 this encompassed nearly 24,569 articles, providing a comprehensive starting point for the sample.

The studies were limited to peer-reviewed articles that hypothesized a relationship between one (or more) quality management practices and one (or more) measure of firm performance. Studies were not limited by method or theory, as long as effect size data was included. The studies were limited to logistics organizations (e.g., plants and shipping firms) and studies of the logistics departments or quality assurance offices of larger organizations. This included both manufacturing and service firms but excluded studies where the field of employment were not explicitly identified. As a result of these exclusion criteria, many qualitative studies and all studies before 1990 were excluded because they lacked effect size data and failed to specify a domain.

This process narrowed the initial results to 81 studies, including studies from one pertinent meta-analysis (Nair, 2006). Article abstracts were then reviewed, eliminating twenty-one unrelated studies that did not meet domain or construct criteria. Another 28 publications did not include effect size data but presented regression model correlations or p-values. An effort was made to contact corresponding authors via corresponding email addresses and Research Gate profiles to request the data, which garnered one useful study. Citation network analysis (i.e., backward and forward searches) then yielded 55 additional useful studies, including studies from two pertinent meta-analyses (Mackelprang and Nair, 2010; Abreu-Ledón et al., 2018). For these studies, correlation

and Cronbach's alpha/composite reliability statistics were taken from the original publication whenever possible. In total, 78 useful studies were identified. Some sample studies present multiple effect sizes for different operationalizations of key constructs; for this meta-analysis, these effect sizes have been included individually, without averaging, for a total of 1,120 sample effect sizes. Appendix A-1 lists the primary studies utilized in this meta-analysis. Appendix A-2 and A-3 provide a sample of study classification and the transformation of sample effect sizes.

2.3.3 Sample Characteristics

Quality management topics have been consistently discussed in a wide array of journals since the early 1990s. This is represented in our diverse sample of empirical studies, which incorporates articles published between 1992 and 2017 from twenty-three unique journals. The most prominent journals, publishing the highest number of relevant studies, were the International Journal of Production Research and the Journal of Operations Management (fifteen articles each); the International Journal of Production Economics and Decision Sciences were also well-represented with ten and seven relevant studies, respectively.

The sample studies most often relied on data from manufacturing firms (61 articles). This meta-analysis aimed to generalize the relationship quality management practices and performance and therefore also included studies of non-manufacturing firms, including four studies of service organizations (logistics providers: Panayides, 2007; Brah and Lim, 2006; various services: Brah et al, 2000; hospitals: Douglas and Judge, 2001), three other (electronics firms: Ho et al, 2001; vendors: Li et al, 2011; industrial firms: Camisón and Puig-Denia, 2016), and ten studies of both manufacturing

and non-manufacturing firms. Notably, there does not appear to be a significant difference in how manufacturing and service organizations leverage quality management practices. In a validation study of the Malcolm Baldrige National Quality Award (MBNQA) framework, Pannirselvam and Ferguson (2001) found that “manufacturing organizations are becoming more flexible and customer responsive, while service firms are becoming more focused on quality process and output” (20). Table 2 provides a summary of the sample studies used in the meta-analysis.

Table 2. Meta-Analysis Sample Summary

<i>Industry</i>	Total n (%)	<i>Location</i>	Total n (%)
Manufacturing	61 (78%)	Asia/Pacific	27 (35%)
Service	4 (5%)	Americas	31 (40%)
Mixed	10 (13%)	Europe/Africa	8 (10%)
Other	3 (4%)	Multiple	9 (12%)
<i>Firm Size</i>	Total n (%)	Unspecified	3 (4%)
Small (<100)	7 (9%)	<i>Year of Publication</i>	
Medium (100-500)	25 (32%)	Range	1992-2017
Large (>500)	17 (22%)	Median	2005
Unspecified	29 (37%)	Mode	2014, 7 (9%)
<i>Journal</i>			Total n (%)
Int. J. of Production Research			15 (19%)
Journal of Operations Management			15 (19%)
Int. J. of Production Economics			10 (13%)
Decision Sciences			7 (9%)
Int. J. of Quality and Reliability Management			4 (5%)
Production and Operations Management			3 (4%)
Total Quality Management			3 (4%)
Other			21 (27%)

Sample firms were most often operating in North America (31 studies) and Asia/the Pacific (27 studies). This meta-analysis found only seven relevant studies focusing on firms in Europe, one for Africa, and no studies for South America. These

regions were covered in part by the nine studies which spanned multiple regions; notably, Hong et al (2014) and Belekoukias et al (2014), which were worldwide studies.

Primary studies defined firm size in different ways but most commonly by the number of employees. Approximately one-third (32 percent) of sample studies examined medium-sized firms (between 100 and 500 employees), 22 percent examined large firms (500+ employees), and 9 percent studied small firms (fewer than 100 employees); while the remaining 37 percent of the sample studies did not publish this statistic. These studies either published alternate firm size statistics (e.g., sales volume, as in Fullerton and McWatters, 2001) or the effect was controlled in accordance with Benitez-Amado et al (2010) by computing the natural logarithm of the total number of the firm's employees (e.g., Ghobakhloo and Hong, 2014).

2.3.4 Variables

The independent variable in this study, organizational quality management practice, was operationalized differently across sample studies – sometimes as a single measure (e.g., Anderson et al, 1995; Ahire and O'Shaughnessy, 1998; Rungtusanatham et al, 1998; Ho et al, 2001), but most often as a multi-dimensional construct. QM practice constructs were classified in accordance with the majority of the component measures. Therefore, similarly named constructs were sometimes classified in different practice categories. The majority (74 percent) of studies explicitly stated one (or more) QM philosophies of interest and applied relevant criteria to their study of QM practices. Of the 1120 primary study effect sizes included in this meta-analysis, the majority of QM practices were classified as technical practices (612), with 249 behavioral practices and 259 collaborative practices.

Practice is examined in terms of three classifications: technical (i.e., direct process or operations management practices), behavioral (i.e., internal relationship-oriented practices), and collaborative (i.e., external relationship-oriented practices). With respect to technical QM practices, the most commonly studied examples were statistical process control (19), just-in-time flow (16), process management (15) and setup time management (15). A total of 25 unique technical practices were used in the primary studies, including benchmarking, scheduling, supply management, value stream mapping, and continuous improvement.

The most frequently cited behavioral QM practices were leadership and management (24) and employee development (22). An additional nine practices were studied, including human resource management, management of technology, organizational learning, quality culture, employee empowerment and strategic planning. One study used the term common practices in a study of total quality management, just-in-time, and total productive maintenance techniques in order to study these behavioral practices central to multiple QM philosophies (Cua et al, 2001). The study of collaborative QM practices was either focused on the customer (36) or the supplier (31). A few studies also examined practices that could benefit the entire supply chain such as information management and integration.

The dependent variable in this study, organizational performance, was similarly examined in three categories: primary (i.e., the direct result of QM practices), secondary (i.e., indirect results), and innovation. Studies utilized different constructs to represent firm performance, often using multiple measures and constructs. Within primary performance, studies most often cited operations performance (19), as well as

performance outcomes related to delivery, inventory management, manufacturing cost and flexibility. For secondary performance, studies most commonly measured financial performance (30), as well as customer service, employee performance and supplier performance. Relatively few studies in the sample (8) examined the relationship between QM practices and innovation performance. Those that did, studied general innovativeness (5), while a few specifically examined product or process innovation. Of the 1120 sample effect sizes, only 69 of the sample effect sizes related to innovation performance (compared to 631 for primary performance and 420 for secondary performance).

2.4 Results and Analysis

The three hypotheses were evaluated using SEM-based meta-analytic random- and mixed-effects models. These models aggregate Pearson correlation (r) coefficients from primary studies, each of which represents a bivariate relationship between a practice and a performance variable of interest. The corrected r value (r_c) was used, adjusting the published r correlation using the reliability measure known as Cronbach's alpha (or similar), when applicable. Then, the r_c value was transformed using Fisher's transformation method to compare study effect sizes across different studies (Cheung, 2015). A useful benchmark for interpreting correlation coefficients in social and behavioral sciences was set by Cohen (1992), whereby a correlation coefficient of 0.5 may be considered strong, 0.3 moderate, and 0.1 weak.

2.4.1 Hypothesis 1: General Model

The first hypothesis – that of the general model – was evaluated using a SEM-based random-effects meta-analytic model. This model was fitted for the overall effect between two aggregated constructs – quality management practices and organizational performance. Table 3 and Figure 4 show the results of this model.

Table 3. Meta-Analysis General Model Results

	Estimate	Standard Error	Lower Bound	Upper Bound	z-value	Significance
Intercept	0.3744	0.0084	0.3579	0.3908	44.61	0.000***
Tau (τ^2)	0.0706	0.0033	0.0641	0.0772	21.12	0.000***

Significance: '***' <0.001 '**' <0.01 '*' <0.05

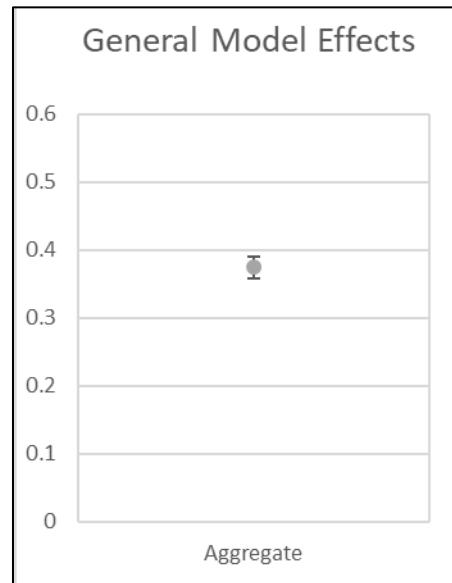


Figure 4. Meta-Analysis General Model Results Graph

The estimated true population effect size (β_R) was found to be 0.3744, which positive and moderate, significant at with an alpha (α) level of 0.001. Thus, the cumulative evidence from the analysis proves that quality management practices are moderately associated with firm performance measures and supports the general

relationship proposed in hypothesis 1. This finding is consistent with the literature in quality management.

Additionally, sample homogeneity statistics show that our sample may be from multiple populations, supporting further study of hypotheses 2 and 3, and justifying our SEM-based approach. The variance of the true effect sizes (τ^2) is 0.0706 and also significant at $\alpha = 0.001$. The Q statistic (19,300) was significantly high for the degrees of freedom (1,119). Alternately, the I^2 value (0.946) indicated that the between-study effect explains 94.62 percent of the total variation. As a result, the homogeneity of our sample was rejected in accordance with Card (2012). This result also supports the testing of additional models in hypotheses 2 and 3 with dummy variable categories.

2.4.2 Hypothesis 2: Organizational Practice Model

To evaluate our second hypothesis, quality management practices were split into three categories – technical, behavioral and collaborative – and effect sizes were analyzed between each category and aggregated organizational performance. The SEM-based mixed-effects meta-analytic model used dummy variables to indicate the practice category of interest. Table 4 and Figure 5 display the result of the mixed-effects organizational practice model.

As the results show, the coefficients of three types of QM practices were positive and significant, partially supporting hypothesis 2. For technical QM practices, the point estimate and the 95 percent confidence interval (CI) are 0.3577 and (0.3354, 0.3800); for behavioral QM practices they are 0.4083 and (0.3738, 0.4427); and for collaborative QM practices they are 0.3803 and (0.3461, 0.4144). Although point estimates for behavioral

and collaborative QM practices are greater than that of the practical QM practices, all three CIs are overlapping, which implies that their differences may be due to sampling.

To examine this result further, this model was compared with the general model using analysis of variance (ANOVA). The analysis resulted in a likelihood ratio statistics $\Delta\chi$ of 5.976 (p-value > 0.05), with two degrees of freedom, which is insignificant at $\alpha = 0.05$. Accordingly, the null hypothesis was not rejected; there was no difference between the two models. Thus, classifying QM practices is not meaningful for understanding the relationship between QM practices and organizational performance.

Table 4. Meta-Analysis Practice Model Results

	Estimate	Standard Error	Lower Bound	Upper Bound	z-value	Significance
Technical	0.3577	0.0114	0.3354	0.38	31.44	0.000***
Behavioral	0.4083	0.0176	0.3738	0.4427	23.23	0.000***
Collaborative	0.3803	0.0174	0.3461	0.4144	21.85	0.000***
Tau (τ^2)	0.0703	0.0033	0.0638	0.0768	21.12	0.000***

Significance: '***' <0.001 '**' <0.01 '*' <0.05

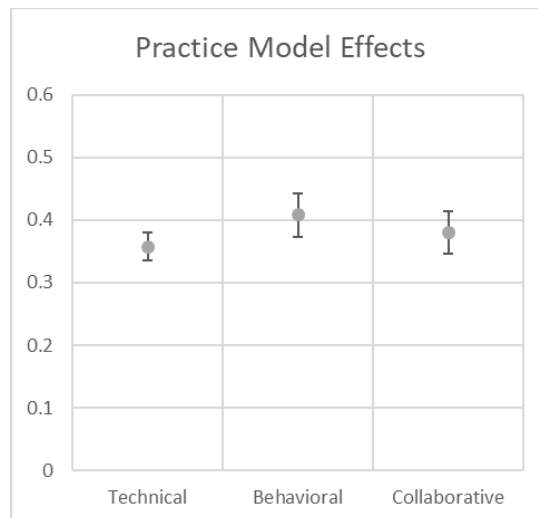


Figure 5. Meta-Analysis Practice Model Results Graph

2.4.3 Hypothesis 3: Organizational Performance Model

Finally, a third model was tested, using three categories of organizational performance. Following Ebrahimi and Sadeghi (2013), performance measures were classified into primary, secondary, and innovation performance categories. The performance category was included in the model as an indicator dummy variable in the mixed-effects model in the same way described in the practice model. Table 5 and Figure 6 show the result of the organizational performance model.

Table 5. Meta-Analysis Performance Model Results

	Estimate	Standard Error	Lower Bound	Upper Bound	z-value	Significance
Primary	0.3485	0.0112	0.3266	0.3704	31.18	0.000***
Secondary	0.4015	0.0135	0.375	0.4281	29.67	0.000***
Innovation	0.4387	0.0331	0.3738	0.5035	13.26	0.000***
Tau (τ^2)	0.0697	0.0033	0.0632	0.0762	21.09	0.000***

Significance: '***' <0.001 '**' <0.01 '*' <0.05

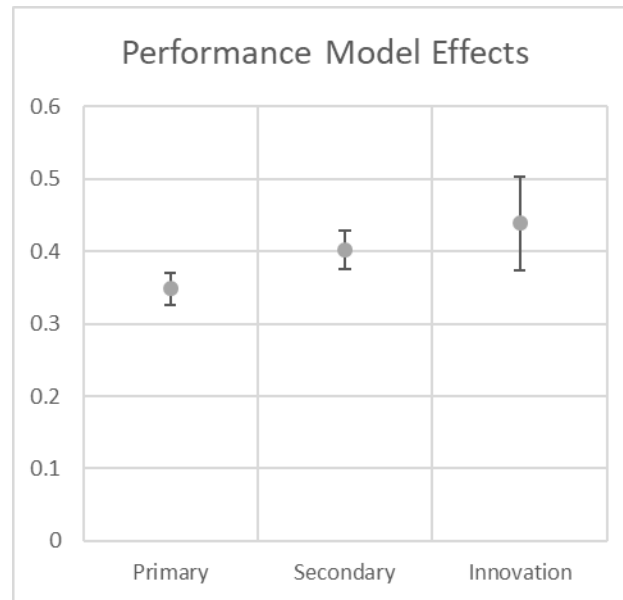


Figure 6. Meta-Analysis Performance Model Results Graph

Overall, the model was significant for all performance categories, supporting hypothesis 3. For primary performance, the point estimate and the 95 percent CIs are 0.3485 and (0.3266, 0.3704); for secondary performance, they are 0.4015 and (0.3750, 0.4218); and for innovation performance, they are 0.4387 and (0.3738, 0.5035). The effect size estimate for innovation performance approaches the threshold for a strong correlation, but with some caveats. Only 69 of the sample effect sizes related to innovation performance (compared to 631 for primary performance and 420 for secondary performance), resulting in a correspondingly larger standard error and CI. Nonetheless, the 95 percent CI for the primary performance category is smaller than those of the remaining two performance categories without overlapping with them.

Using ANOVA, this model was tested against the general model. The result revealed that the likelihood ratio statistic $\Delta\chi$ was 13.08 with two degrees of freedom, significant at $\alpha = 0.001$. Thus, the null hypothesis was rejected; the two models are different. This result further supports the finding in the performance model. As the 95 percent CI for primary performance category does not overlap with those of secondary and innovation performance categories, this study concludes that QM practices are more strongly correlated to the secondary and innovation performance categories than the primary performance category.

2.4.4 Analysis

This paper applied SEM-based meta-analytic models to evaluate three hypotheses related to the relationship between quality management practice and organizational performance. A random-effects model was used to evaluate the general relationship

between pooled practice and pooled performance, and an additional two mixed-effects models applied categories first to the practice variable and then the performance variable.

The first hypothesis, that quality management practices are positively associated with firm performance, was supported. This general model was tested using a SEM-based random-effects meta-analytic model, which resulted in a significant and moderate effect.

The application of SEM-based methods was justified by high heterogeneity test statistics. Support for the model demonstrates that the generalized practice of quality management can benefit a diverse group of firms, independent of QM philosophy or contextual variables. This may be due in part to the numerous common practices between philosophies.

Support for the general model demonstrates cumulative evidence in support of quality management practices, clarifying mixed results from previous studies. Bolstered by the resource-based view, this relationship shows that organizational practices act as enabling capabilities that positively impact competitive performance. Furthermore, by clarifying conflicting results from individual studies, the study supported the implementation of quality management practices at the firm level.

The second hypothesis, regarding the effects of practice categories, was not supported. The study classified practices into three different categories – technical, behavioral, and collaborative – and tested the relationship between each practice category and pooled firm performance. This mixed-effects model accounted for both within- and between-study variance, attempting to address some of the general model's heterogeneity.

While all practice categories were positively and significantly correlated with aggregate performance, these effects were not distinctive. Comparable point estimates with overlapping confidence intervals, and the failed ANOVA comparison to the general model, indicated that the practice model was not a good fit.

Organizational investment in quality management capabilities is positively correlated with performance, but our understanding of this dynamic is incomplete. The lack of clearly superior practices categories or philosophies (i.e., resources/capabilities) results in vague generalization for theory-building or managerial use. Further examination is warranted.

Hypothesis three, with categories of performance, was found to be mostly supported. The performance model tested different the three categories of organizational performance – primary, secondary, and innovation. The results of this model showed positive and significant correlations, as well as a favorable ANOVA test demonstrating difference from the general model.

The confidence intervals for secondary and innovation performance overlapped, indicating that these indirect performance effects are indistinct. Conversely, primary performance was separate, with a significant but weaker correlation. These findings indicate that the indirect benefits of QM practices on secondary and innovation performance are greater than the direct benefits on primary performance outcomes. This surprising result can inform quality management theory and amend expectations of program managers.

2.4.5 Recommendations for Practitioners

These results lead us to two main recommendations for practitioners and managers, for the improvement of logistics operations and performance:

(1) The findings recommend the implementation of a diverse quality management program, which includes a range of technical and non-technical practices. While technical practices tend to be the focus, non-technical practices have been proven to meaningfully contribute to organizational performance as well and should be included in these programs. This research does not support limiting a quality management program to one particular philosophy or approach; instead, the study findings recommend drawing best practices from the entire body of knowledge.

(2) The quality management program should be assessed using a similarly diverse set of performance measures. The most substantial benefits lie in indirect performance outcomes, which can be easily overlooked as they may be more difficult to measure. These performance measures should align with a succinct set of stakeholder priorities and performance goals.

2.5 Discussion

In this rapidly changing operating environment, organizations have realized the critical role of logistics and operations management in long-term successful performance. Quality management programs are central to this effort, comprised of numerous and varied practices –resource-based capabilities – that provide competitive advantage through an array of positive performance outcomes.

This study examined what relationships exist between quality management practice and organizational performance in terms of three models and corresponding hypotheses: a general model, a model utilizing categories of practice, and a model utilizing categories of performance outcomes. Leveraging SEM-based meta-analytic methods and a resource-based view of the firm, this study identified quality management practices as resource-based capabilities, essential to positive performance outcomes and lasting advantage. This meta-analysis amassed 1,120 effect sizes from 78 primary empirical studies on the relationship between quality management practices (technical, behavioral, and collaborative) and firm performance (primary, secondary, and innovation).

2.5.1 Theoretical Implications

Scientific advancement requires original research, replication and accumulation, and “many areas of social science research are in less need of further research than they are in need of the organization of existing research” (Card, 2012, as cited in Abreu-Ledón et al, 2018). This study solidifies quality management practices as resource-based capabilities that provide competitive advantage through a variety of positive performance outcomes. The models generated cumulative evidence to define various practice-performance relationships, thus facilitating the extension of these findings to other areas of the domain in support of a theory of quality management. This study was the first to aggregate primary studies both from diverse types of logistics firms (e.g., manufacturing and logistics service providers) and a wide range of QM philosophies (e.g., TQM and just-in-time). Findings provided evidence to support a positive and significant general relationship.

The traditional approach to studying QM practice was not supported by our findings. The study of these practices had most often been within philosophical silos, or through binning, neglecting to consider that many practices, especially leadership, behavioral and human resource practices, are common to many QM approaches. This myopic view has limited generalizability and understanding (Camisón and Puig-Denia, 2016; Cho et al, 2017).

The categories used for performance outcomes, however, were partly supported. This provides a useful alternative for future study. QM practices were found to correlate more strongly with indirect performance outcomes than with direct (primary) performance outcomes, counter to common perception.

Meta-analytic methods pave the way for future theory building by providing cumulative evidence of the relationship that are generalizable and not well-explained by single studies. Additionally, the study contributed to the logistics and supply chain domain by extending the application of SEM-based meta-analysis techniques in support of a comprehensive QM theory. Meta-analysis and related methods are used extensively in medical fields but have been underutilized in logistics and supply chain management. Topics relating to quality and performance management are appropriate for the application of these methods, as numerous empirical primary studies exist and are diverse in nature.

2.5.2 Managerial Implications

This study provides cumulative evidence in support of quality management program implementation across a wide range of logistics organizations and operating settings. The quality management practices studied here in were diverse, including total

quality management, just-in-time, lean, continuous improvement, and numerous others. The findings of this study indicate that, as QM practices are often not unique to one philosophical approach, they are also not unique in their impact on firm performance. Thus, practitioners do not need to differentiate between types of QM practices or choose between QM philosophies, and should instead look to draw a diverse set of best practices from the whole body of knowledge. Furthermore, while the emphasis is often on technical practices, this study has not found evidence to suggest that a technical approach is preferred.

Second, QM practices impact secondary and innovation performance categories more strongly than primary performance. Therefore, firms that implement QM practices may observe more indirect benefits than direct results. Managers should expect the most significant results from these programs to be indirect, and they should measure the success of the program accordingly, using a set of holistic metrics.

2.5.3 Limitations and Future Research

This study represents a step toward the generalization of knowledge for a comprehensive QM theory, as well as practical insights for the alignment of firm-level actions with desired performance outcomes. The major limitation of this study resides within that of the primary studies used in our analysis. As the majority of primary studies focused on TQM practices in manufacturing settings, the findings may favor these conditions. The relationship between QM practices in different logistics settings may deviate from these generalized findings, especially in more dynamic supply chain settings (e.g., fast-paced research and development and disaster response logistics). Additional

empirical studies from more varied settings will improve the generalizability of results and recommendations.

Further research could add depth to the study of quality management practice and innovation. Within resource-based theory, dynamic capabilities for change and learning can take many forms, including an array of practices related to knowledge management, teaming, benchmarking, after-action review and learning. A larger sample – and more relevant primary research – may clarify the resultant impact on innovation and other measures of performance.

Rather than categorizing QM practices and performance measures, future studies may include different constructs and conduct meta-analytic structural equation modelling analysis for multivariate results. Alternately, further studies could generalize the effect of various contextual variables. Some of the contextual variables explored in these primary studies included characteristics of the sample firms (e.g., plant age, industry or sector, nation of ownership, unionization, "world class" reputation, and quality certification) and respondents (e.g., age, job title, tenure, and management experience). Mackelprang and Nair (2010) studied a range of these contextual elements and interaction variables, finding moderating factors to significantly influence the majority of the study's just-in-time practice-performance relationships. Alternately, Abreu-Ledón et al (2018) found level of economic development to be the only significant moderator. These mixed results could be explored further in order to gain clarity.

Another interesting avenue of inquiry is the effect of time on the practice-performance relationship. The length of time that a practice has been in place plays a factor, due to organizational familiarity, incremental improvements, and the later addition

of complementary practices, which may all serve to improve aggregate performance (Agus and Iteng, 2013). A future study could also examine the performance outcomes with regards to the order in which practices were adopted.

Furthermore, while secondary performance was impacted more strongly than primary performance, that data relied heavily on financial performance measures. Our category of secondary performance included numerous performance measures encapsulating both upstream and downstream stakeholder priorities. Additional study of this category of performance could provide a foundation for a multi-criteria decision making model to enable the extension of quality management practices into fields where profit and financial performance are less central to operations and decision-making (e.g., government, military, and not-for-profit organizations) and where diverse stakeholder groups create a wide range of secondary performance objectives (e.g., humanitarian response operations).

III. The Humanitarian Operating Environment

3.1 Introduction

From 2010 to 2019, over 3830 natural disasters occurred, worldwide, with the highest number of these taking place in the Asian Pacific, due to its size and susceptibility (Wang, 2020). A disaster is defined as a “disruption that physically affects a system as a whole and threatens its priorities and goals,” often with some qualifying loss metric (Van Wassenhove, 2006: p. 476). Due to population growth, urbanism, land use and the stressing of ecosystems, climate change, and resultant effects on migration, urbanization, food and water stores (Pedraza-Martinez and Van Wassenhove, 2016), experts forecast a five-fold increase in disasters over the next 40 years (Kovács and Spens, 2007). To address these and other disasters, organizations of all kinds engage in humanitarian operations. These operations may be proactive, undertaken in *steady* pre-disaster states, in order to mitigate the effects of a future disaster or prepare a population, or humanitarian operations may take place in a *dynamic* post-disaster state in response to a natural or man-made disaster.

Disaster relief is 80% logistics, and can be improved through efficient and effective logistics, operations and supply chain management, referred to here as *humanitarian operations management* (HOM) (Van Wassenhove, 2006). Supply chain disruptions can cause a crisis (e.g., famine) or contribute to a crisis (e.g., food and water shortages after an earthquake), and temporary humanitarian supply chains are inherently more vulnerable to macro supply chain risks. Improving performance in this context is therefore critically important (Van Wassenhove, 2006). Proper alignment and

coordination of the humanitarian supply chain can drive successful execution of relief efforts; however performance management in this setting is complicated by numerous factors (Yadave and Barve, 2015).

This chapter serves as an introduction to the unique humanitarian operating environment, which will be examined in the rest of the papers of this dissertation. The chapter introduces the main factors which drive performance objectives – humanitarian principles, the humanitarian response cycle, and key stakeholders.

3.2 Humanitarian Principles

Humanitarian organizations are guided by the principles of humanity, neutrality impartiality (Van Wassenhove, 2006). However, finite resources place limitations on an organization's capability for humanitarian assistance (Ransikarbum and Mason, 2016). Trade-offs are unavoidable between ethical, egalitarian (e.g., maximizing quantity or speed) and utilitarian (e.g., prioritizing aid to the most vulnerable populations) objectives as well as other traditional operations management performance objectives (e.g., response time, service level, resilience, flexibility and cost efficiency).

These constraints are pervasive even in large humanitarian organizations, as they are often engaged in separate, simultaneous relief and risk reduction/development projects. This operational mix drives the need to balance an increasing number of objectives on a global scale, to budget for both long- and short-term operations, and to establish supply networks suitable to meet the different types of demand (Pedraza-Martinez and Van Wassenhove, 2016). This efficiency-equity tension is distinctive of humanitarian operations management (Starr and Van Wassenhove, 2014). While

humanitarian operations managers may not wish to decline assistance to remote populations on the grounds of cost, resource insufficiency may also limit their ability to serve those populations adequately; this results in a set of difficult, ethical choices, further stressed by the pressures of urgency and operating under imperfect information.

3.3 The Humanitarian Response Cycle

Performance goals and priorities shift as the humanitarian response cycle advances, further complicating HOM performance management. With such a wide range of objectives pertinent to humanitarian performance outcomes, options for resource investment are subsequently varied, and often tied to a specific phase of humanitarian response. The humanitarian response cycle, begins with the *steady state* – with mitigation, in which organizations pursue investments to minimizing negative disaster outcomes, and preparation, which centers on education and training. After a disaster occurs, operations shift to the *dynamic state*, for immediate recovery efforts and then reconstruction. As a result, measuring performance against these varying objectives is also challenging.

During the steady state, assisting organizations may pursue various investment activities, typically centered on building resistance capability or recovery capability (Melynk et al, 2014). Resistance capability refers to “the ability of a system to minimize the impact of a disruption by evading it entirely (avoidance) or by minimizing the time between disruption onset and the start of recovery from that disruption (containment)” (36). As humanitarian organizations are unable to control when and where a disaster will hit, this is restricted to activities which minimize disaster severity (e.g., building a flood

wall), or increase preparedness and immediate reactionary capabilities (e.g., equipment and training of first responders). Recovery capability is “the ability of a system to return to functionality once a disruption has occurred” (36). This includes immediate reactionary capabilities, as well as various capabilities related to later-stage coordination and execution (e.g., familiarization with humanitarian community processes and resources, engagements to build local medical or engineering expertise). Preparedness has five main facets – human resources, knowledge management, operations and process management, financial resources, and the community and collaborating with key players (Van Wassenhove, 2006).

Once a disaster has been declared, operations shift to dynamic state, speed "at any cost," as the first 72 hours are crucial (480). This phase emphasizes short-term goals, flexibility and agility to quickly respond to minimize suffering and loss of life. The most urgent needs are to provide food, water, medicine, shelter, and critical supplies to address the most pressing needs of the most vulnerable populations, followed quickly by restoration of critical network infrastructure (Tomasini and Van Wassenhove, 2004; Van Wassenhove, 2006). The humanitarian supply chains setup in the early hours of disaster relief are often unstable, unpredictable, with a very limited capability to respond to the needs of the affected people (Yadave and Barve, 2015). In this phase, organizations should act to meet observed or requested needs, without contributing to “the second disaster” of unsolicited donations and inappropriate aid. The sense of urgency often conflicts with needs and risk assessment, knowledge management and collaboration efforts which could improve performance.

In the later-stage recovery and reconstruction phase, cost efficiencies and sustainment become important again, as operations shift back toward steady state, as well as the effective transition of operations to local agencies or other humanitarian organizations. It is unclear exactly when recovery ends; most refer to the assumption of normal supply chain operations as a key indicator, however, this may not be at pre-disaster performance levels. Many assisting organizations aim to *build back better*, to improve the resistance or recovery capability for future disasters, which may transition into steady state disaster risk reduction projects, local preparation engagements and subject-matter expert exchanges, or longer-term development projects. Alternately, some humanitarian organizations aim to *do no harm* – to return the population to its pre-disaster baseline. The underlying logic, here, is that new technologies and methods may be unfeasible or unsustainable in a community, for a number of reasons with which an external assisting organization may be unfamiliar (e.g., lack of trained mechanics, unstable power supply, unsupportive cultural factors or social dynamics). In either case, the assisting organization aims to help the assisted population reach their goal of self-sufficiency for a future response. In all phases of the humanitarian response cycle, solutions must be localized if they are to be effective in the long-term.

3.4 Diverse Stakeholders

The humanitarian supply chain is a network made up of suppliers and providers, but also international humanitarian networks, governments, militaries and beneficiaries; these are loosely pooled into *assisting* and *assisted* actors. When disasters require outside assistance, it is often on a large scale, requiring deliberate design and coordination in

order to effectively manage material, information and financial flows (Van Wassenhove, 2006). The high number of actors and stakeholders in the humanitarian relief environment, especially after sudden-onset natural disasters such as this one, can make coordination in the post-disaster environment chaotic. Proper management and coordination can drive successful execution of relief efforts (Yadave and Barve, 2015).

The assisted parties include the various levels of host government and diverse civilian population. The assisted state should lead the response effort, with assisting parties integrating into the local disaster management office to provide aid as requested/needed, according to the assisted state's guidance. Under international humanitarian law, if a civilian population lacks essential supplies, the state is obligated to ensure that humanitarian assistance is provided. The state "shall request or accept" aid and allow a third party access (ICRC, n.d.). In some cases, coordination with the host government can be harmful, or at best, unproductive. In man-made disasters, conflict zones, or in cases of government mismanagement of resources, tensions can negatively impact relief processes if the host nation has regulatory and enforcement capability. In these cases, the local government may be unaccommodating, opportunistic, selectively accommodating, or nonrestrictive – either due to a lack of desire to cooperate or a lack of control or enforcement capability (Dube et al, 2016). In post-disaster settings and other accommodating or nonrestrictive environments, the assisted state may or may not be capable of leading the response effort. Local responders and their families may, themselves, be in need of essential aid.

Assisting parties include a diverse range of humanitarian organizations, military organizations, and international aid networks. Some humanitarian organizations are

local, national, regional, or international; government organizations and non-governmental organizations; cause-based, faith-based, or aligned with a particular demographic; others have technical or medical expertise. Support may be requested from military organizations to provide short-term unique capabilities, often in order to reopen an airport or to provide cargo airlift. Some organizations provide resources, expertise, or funding to other aid organizations who serve as implementing partners (e.g., The United States Agency for International Development's Office of Foreign Disaster Assistance, USAID/OFDA), and others aim to organize and coordinate the relief effort (e.g., the United Nations Office for the Coordination of Humanitarian Affairs, UNOCHA). The UNOCHA cluster system was developed in 2005 to organize humanitarian organizations around their functional missions, providing an avenue for improved centralization and consensus (Jahre and Jensen, 2010). Co-locating these organizations can create opportunities for cooperation and synergy, resource pooling, and the creation of a common logistic operating picture (Tatham et al, 2017). However, the barriers to cooperation at this level are significant and, if achieved, may also effectively restrict the autonomy of humanitarian organizations, diminishing unique contributions or advantages.

Humanitarian relief chain resourcing and financial flows are also significantly impacted by donors and the media. Private and public donors may provide earmarked funds, which can legally only be used for specific purposes. These earmarked funds tend to favor immediate disaster relief efforts, drawing resources away from proactive and preventative steady state investments. Similarly, news media tends to neglect steady state conditions, providing coverage – which draws donors – mostly during the immediate

aftermath of sudden-onset natural disasters. These trends effectively limit the progress that can be made during steady state (Van Wassenhove, 2006).

3.5 Conclusion

Logistics, operations and supply chain management in humanitarian settings must contend with unique challenges. More so than typical supply chain disruptions, disasters threaten lives and livelihoods. It is therefore critically important that humanitarian relief supply chains can be established expeditiously and effectively, without causing further harm, in order to minimize loss and suffering. This chapter introduced the humanitarian principles, the response cycle, and the diverse set of stakeholders that complicate and enrich humanitarian performance management.

IV. Humanitarian Learning: Insights for the Alignment of Organizational Practice and Performance in Humanitarian Operations

4.1 Introduction

HOM practices are critically important to the success of the relief operation as a whole (Van Wassenhove, 2006). HOM encompasses logistics, operations and supply chain management practices; it is the most expensive component of response and that which enables effective and rapid aid delivery, as well as performance measurement, management and after-action learning (Van Wassenhove, 2006; Thomas and Mizushima, 2005). Effective relief can be severely undermined by mismanagement, duplication of effort, wastefulness, and bottlenecked supply processes (Altay, 2008; Ozdamar et al, 2004).

Chapter II serves to establish how many organizations effectively employ quality management programs to manage operations toward a variety of performance outcomes. As outlined in Chapter III, the humanitarian operating environment has some unique challenges that complicate performance management and improvement. While market competition drives a need for innovation in for-profit firms, for humanitarian organizations it is the operating environment that both drives and complicates this effort. These unique features include humanitarian principles, the humanitarian response cycle, and a multitude of stakeholders. Few other fields routinely face such high levels of complexity, uncertainty, or risk compounded by the challenges of local, multinational and civil-military coordination (Van Wassenhove, 2006; Thomas and Mizushima, 2005).

Researchers in this domain have called for studies to address challenges serving the urgent needs of beneficiaries and sustaining these efforts (Galindo and Batta, 2013; Ransikarbum and Mason, 2016). These goals requires a range of different organizational capabilities to meet the unique priorities and challenges present in dynamic humanitarian states (i.e., post-disaster response operations) and in steady states (e.g., disaster risk reduction projects). These calls for research emphasize addressing practitioner concerns, through collaboration and using data from the field, in order to better understand the realities of the humanitarian context and competing objectives (Pedraza-Martinez and Van Wassenhove, 2016). As practitioner concerns extend beyond traditional operational performance metrics, researchers have responded with a recent push for nontraditional measures of humanitarian performance (e.g., equity measures, appropriateness, and sustainability) and unique collaborations. Collaboration is a powerful tool with pervasive effects throughout the disaster response cycle. In humanitarian operations, a community-driven approach is essential; “one-size-fits-all” solutions are not effective and that any aid is most certainly *not* better than no aid.

However, collaboration is not without its challenges. Diverse stakeholders contribute distinct perspectives and capabilities, as well as divergent expectations, normative standards and priorities. The field recognizes that there are a multitude of problems associated with the misalignment between objectives and processes, as well as goal conflict (Haavisto and Goentzel, 2015). Commitment and cooperative behaviors such as information sharing and preparation activities can align partner organizations, thus mitigating these concerns. Early pre-disaster investments can support lasting trusting inter-organizational relationships, while post-disaster investments support the

development swift trust among temporary teams (Dubey et al, 2017). Steady state knowledge co-creation with partners contributes to the effectiveness of early operations (i.e., planning, mitigation and early response/implementation) and helps balance power structures in later operations (i.e., response and recovery) when more accurate, insightful data is urgently needed (Lu et al, 2013; Piquard and Delft, 2018; Eriksson et al, 2017).

Few studies have explored how humanitarian organizations create, acquire and retain knowledge, either internally to the organization or in collaborative learning networks. Many humanitarian organizations have adopted a retrospective process to document their actions and observations at the end of an operation. These reports (*learning documents*) are a standard part of redeployment and close-out, with varying degrees of collaboration, organizational emphasis, buy-in, and resultant change. Some such documents tend to be descriptive in nature (e.g., after-action reports, AARs), while others tend to be more prescriptive, providing lessons and recommendations for improvement (e.g., lessons learned reports, LLRs). Occasionally, retrospective findings are aggregated to form larger case studies or cumulative reviews, drawing from multiple organizations to study a single response effort, or to compare between events; however, these efforts are less common.

Chapter II generated cumulative knowledge to support generalized relationships between organizational practice and performance. In academic literature, “As the number of case studies on a certain topic grows, it becomes increasingly important, however difficult, to integrate their collective meaning” (Berger, 1983: 308). The current study applies this same logic, founded in resource-based theory, to the humanitarian operational setting. This study examines a wide range of HOM practices and their

connections to performance outcomes, as reported by practitioners over a 10-year period of humanitarian operations in the Pacific region. The present study examines how practitioners perceive these topics, and applies organizational learning theory to examine the impact of other factors that moderate the reporting of these relationships. This study provides insight into learning and change potential within these organizations and operational settings.

We assert that patterns exist, with respect to when topics are or are not reported (*inclusion*), and when practice and performance topics are mentioned together (*association*). Furthermore, these patterns of inclusion and association are impacted by the type of learning document, the organization, and the humanitarian setting:

RQ1: *What practice and performance topics are included in humanitarian reports, and how is inclusion impacted by other factors?*

RQ2: *How do practitioners relate organization practice to performance, and how are these associations impacted by other factors?*

This study utilizes a cumulative case study methodology, triangulated with exploratory interviews and statistical analysis of learning documents, employing log-linear association models and proportional analysis. These sources provide glimpses into the practitioner experience and the methodology allows for the accumulation and generalization of knowledge across diverse organizations and settings.

For academic audiences, this study presents a new application of a unique data set for study of performance management across a diverse spectrum of humanitarian operations. Studies of humanitarian performance typically focus on primary performance outcomes (e.g., aid quantity, response time), whereas this study takes a more holistic

view of humanitarian performance. Similarly, the understudied soft dynamics at play in humanitarian response, as well as soft supporting practices, such as leadership are included in this study (Starr and Van Wassenhove, 2014). Exploration of bias in learning documents, and factors that impact honesty in reporting, with consequences for organizational learning and the building of mutually beneficial, trusting inter-organizational relationships. Furthermore, as HOM studies do not typically leverage resource-based theory or organizational learning theory in this way, the study contributes to the understanding of learning and performance in this domain and a theory of humanitarian operations. This is supported through the cumulative case study, which enables generalization for future research and theory building.

For practitioners, this study provides insights to improve the building of organizational knowledge and process improvement, with implications for the wider humanitarian community and for long-term system-wide performance. With a better understanding of how key practices contribute to desired outcomes, managers can focus resources to maximize return on investment, identify lines of effort and better manage competing interests in a time- and resource-constrained environment. Additionally, insights to organizational learning and challenges in this environment may help organizations to improve their internal performance management systems and external collaborative networks. To this end, the current study explores bias and issues related to trust, and provides recommendations for the building of mutually beneficial, trusting inter-organizational relationships and the building of organizational knowledge toward lasting performance outcomes.

The rest of this paper consists of Literature Review, Methodology, Results and Analysis, and Discussion.

4.2 Literature Review

In this section, theoretical foundations are described, along with humanitarian research streams regarding organizational practice, performance and learning. The present study is founded in resource-based theory, which views organizational practices as unique resources and combinative capabilities that provide for desired performance outcomes. Additionally, organizational learning theory is used to explain how practice effectively results in long-term performance, with individual buy-in to the organizational learning process moderating organizational growth for sustained advantage. Literature regarding HOM practice has centered on the isolation of key success factors, while the study of HOM performance – structured with the same three categories from Chapter II – has mostly examined primary performance outcomes. The review of learning challenges and mechanisms describes the impact of knowledge management, time pressures and inter-organizational relationships to bolster the use of organizational learning theory in this setting.

4.2.1 Theoretical Development

Despite growing numbers of humanitarian publications, there has been limited theoretical growth (Oloruntoba et al, 2019). Some recent drives for theorizing within humanitarian operations propose borrowing relevant theories from related disciplines (Pedraza-Martinez and Van Wassenhove, 2016). These efforts are largely focused toward primary performance outcomes of humanitarian supply chain management,

utilizing resource-based (view) theory, stakeholder theory and institutional theory, although further empirical validation is warranted (Behl and Dutta, 2019).

The foundational logic of this study rests in RBT, wherein the successful development and application of resources toward key practices and capabilities supports positive performance outcomes for an organization. A firm's resource base cannot provide value indefinitely. Leadership must work to maintain and improve upon these resources in order to be competitive in the long-term (Penrose, 1959). In acknowledgement of this fact, Teece et al. (1997) extended RBT to include dynamic capabilities, defined as the ability of firms to integrate, build, or reconfigure internal and external competencies to address changing environments. Dynamic capabilities are the change and learning capabilities of a firm (e.g., through visionary leadership or research and development) to "purposefully create, extend, or modify its resource base" (Helfat et al, 2007: 4). This extension of RBT is used frequently in logistics and supply chain management research. It branches resource-based and industrial organizational views, addressing a firm's response to a changing external environment; and it also connects RBT with organizational learning, by viewing learning as an organizational capital resource to be used strategically for competitive advantage.

Organizational knowledge has been viewed theoretically within RBT as a resource which may contribute to competitive advantage, when leveraged expressed in capabilities and leveraged strategically. Some theorists view this as the natural evolution of the resource-based view, with knowledge providing the most valuable, inimitable and immobile competitive advantage of all (Helfat and Peteraf, 2003). This view of knowledge emphasizes an organization's aptitude for capability building, knowledge

creation and advancement (Curado, 2006). Organizational learning plays a key role in the sustainability of organizational capabilities and competitive advantage.

Organizational learning theory (OLT) concerns the processes and mechanisms for changing (adding to, transforming or reducing) organizational knowledge, as well as the effects of organizational knowledge on organizational outcomes, performance and behaviors (Schulz, 2001). Objectives of organizational learning include improving upon an aspect of organizational performance or sustaining the development of organizations and their members. Senge (1990) and March (1991) examined organizational improvement as an iterative process wherein an organization's success (i.e., competitive performance) is therefore dependent on the organization's ability to learn from experiences in each successive cycle.

OLT is rooted in individual learning through the process of detecting and correcting errors. Individual learning is a necessary but insufficient condition for organizational learning; once new knowledge is accepted by an individual, there is a process by which that knowledge must be articulated (transferred) and codified (integrated) in order to aggregate to higher-order groups and become a part of the organization's body of knowledge (Zollo and Winter, 2002). Learning processes and success are impacted by how the organization frames learning through the formal set of rules, policies and procedures which communicate the organization's values and normative standards, *espoused theory*, and how individuals internalize and react to this system, *theory in use* (Argyris & Schön, 1978). The learning documents in this study reflect the individual's recent experience, prior experience, and commitment to formalize new knowledge to push the organization forward.

Many factors can impact how resource-based capabilities are effectively leveraged for performance gains. The present study asserts that the individual's buy-in to the organizational learning process presents as a moderating effect between organizational practice and long-term performance outcomes. The theory in use for the practitioner authoring a learning document is reflected in topics discussed and connections made. Gaps between the individual's observations and codification in learning documents represent points of conflict between the organization's learning objectives and the individual's perspective and buy-in to this process. This theoretical view provides insight into how individual knowledge, specifically with respect to humanitarian operations management practice and performance topics, is codified for the organization. This impacts subsequent dissemination, transfer and change behaviors with implications for humanitarian supply chain effectiveness.

4.2.2 Humanitarian Operations Management Practice

In humanitarian literature, resources and capabilities have often been studied in terms of key success factors, general success criteria, guidelines and strategies (Pettit and Beresford, 2009). An early example, Kembell-Cook's (1984) "10 Commandments" of relief logistics, provided practitioners with a solid foundation. These commandments were: centralized organization, government commitment, autonomy, communications, budget and procurement system, base and port operations, commodity control system, transport fleet management, vehicle workshops, and distribution monitoring.

Many organizational practices commonly used in commercial business have been successfully translated for HOM settings. In terms of technical practices, these include the balanced scorecard (Shulz and Heigh, 2009), benchmarking (Cosgrave, 2013), and

lean six sigma (Parris, 2013). Additionally, Buddas (2014) studied bottlenecks in humanitarian operations using process mapping, critical path analysis and the theory of constraints. Lee's (2004) triple-A supply chain – agility, adaptability, and alignment – is also easily adjusted for the humanitarian supply chain.

Additionally, HOM research has explored the importance of human resources, talent management, and leadership capability. The high rate of burnout and turnover hurts continuity and organizational knowledge. The training and retention of subject-matter experts can also improve disaster response, as this reduces common errors, including the bias towards over-forecasting consumption, which creates a bullwhip effect and the inefficient use of resources (Van Der Laan et al, 2016). Themes of leadership, coordination, and trust are commonly cited as HOM key success factors (Zhou et al, 2011; Oloruntoba, 2010). Leaders must have inter-cultural and cross-cultural knowledge, and their practices must demonstrate insight into and respect for local customs, expectations, and standards (Balboa, 2014).

Additionally, practices related to inter-agency coordination and relationship building, especially in pre-disaster phases, supports collaborative supply chain strategies through risk awareness, knowledge management, and operational agility (Scholten et al, 2014). Common mechanisms include reducing supply base complexity, formalizing risk management, knowledge sharing, complementary use of resources, and joint governance (Dubey et al, 2017). This is supported by general supply chain risk management (SCRM) literature as well. Revilla and Saenz' (2017) study of organizations' SCRM configuration found that “integral” and “collaborative” forms of SCRM performed the best with respect to frequency of disruption. Both these forms of SCRM are

characterized by inter-organizational orientation. They also found that “excellent performance of integral SCRM strategies... ensures the efficacy of internal business continuity plans” (557).

4.2.3 Humanitarian Operations Management Performance

It is only recently, with increased pressure from donors to prove the impacts of aid, that humanitarian practitioners have become more results-oriented (Van Wassenhove, 2006). The study of what makes for effective humanitarian operations management has evolved since then, expanding from mostly operational (*primary performance*) measures to other performance areas, such as those related to equity and appropriateness, which examine other areas of performance and humanitarian operational success. Haavisto and Goentzel (2015) examined how humanitarian supply chain performance is measured in a multi-goal context. Their review included numerous performance measures, including flexibility, resource efficiency, cost, service level (customer/beneficiary/donor), accuracy, financial control and efficiency, process adherence, time (e.g., donation-to-delivery), coverage, equity, utilization, innovation and learning, quality of life and well-being. Still, there is a lack of empirical evidence with respect to how humanitarian organizations set goals and measure performance; by some estimates, only 20 percent of humanitarian organization consistently measure their performance (Haavisto and Goentzel, 2015; Blecken 2010). Additional performance measurement challenges relate to determining meaningful indicators, the learning and development of employees/stakeholders, and the availability of trustworthy data (Abidi et al, 2014). This study utilizes the same three performance categories from Chapter II –

primary, secondary, and innovation (Ebrahimi and Sadeghi, 2013; Prajogo and Sohal, 2003).

Primary. This category of performance outcomes includes those direct results of operations management practices. These metrics often relate to demand fulfilment (e.g., time or volume performance, lead time, fill rate) or efficiency (Behl and Dutta, 2019). In one study, Garcia et al (2012) developed a framework for 1st-level key performance indicators, based on the supply chain operations reference model for commercial production supply chain, and adapted for a humanitarian logistics and supply chain context – quality, timeliness, logistics cost, productivity and capacity.

These metrics are relatively internal to the humanitarian organization, convenient and easy to collect, validate, and manage. As a result, primary performance outcomes have been most heavily researched. Emphasis on convenient primary performance outcomes may lead an organization to oversimplify the objective function, neglecting other aspects of performance (Abidi et al, 2013; Haavisto and Goentzel, 2015). For example, metrics that address the percent of each aid dollar that go directly to supporting beneficiaries fail to consider critical support activities; these activities are then included under “overhead,” with undesirable connotations, or are neglected due to the earmarking of donated funds specifically for direct aid.

Secondary. Secondary performance outcomes are those that follow indirectly from operations management practices. These outcomes are often of special interest to stakeholders, such as financial metrics for donors, safety and security for practitioners, or appropriateness and satisfaction for aid beneficiaries. Additional themes includes outcomes related to local sustainability and inclusion. This marks a significant departure

from traditional commercial business, as organizations in the humanitarian space “seek social impact rather than profit,” (Larson, 2012), driven by the humanitarian principles of humanity, neutrality and impartiality (Van Wassenhove, 2006).

Innovation. The third category of performance outcomes, innovation performance, relates to organization-level improvement and change. This includes internal and collaborative learning efforts, experimentation, and the development or adoption of new procedures, standards, policy, or partnerships. There are few studies of innovation and performance management systems within humanitarian operations and disaster relief logistics. One study, Schulz and Heigh (2009) developed a continuous improvement and performance management tool, adapted from the Balanced Scorecard and SCOR model for the humanitarian context. This study resulted in a simple indicator tool that can be further adapted for an organization to manage and improve performance over time.

4.2.4 Learning Challenges and Approaches

In general, humanitarian operations cannot benefit from routine task repetition, which bolsters incremental learning in most operational environments. One exception is related to seasonal natural disasters, where preparation leading into the season is feasible. Even then, humanitarian practitioners must contend with challenges to knowledge management, time, and coordination with other organizations.

Knowledge Management. Historically, knowledge management has been a hindrance to humanitarian performance measurement. Performance measurement efforts have previously been stalled by technological deficiencies, lagging data analytics, and a

singular focus on obtaining immediate results in the field (Pedraza-Martinez and Van Wassenhove, 2016; Van Wassenhove, 2006). Metrics are problematic as is data quality.

Investments in decision-making models and tools, best practices guides and preparedness templates, early warning systems, communication platforms and community education can mitigate these data-related risks and improve resistance capability. Any tool or platform must be robust and reliable, not easily vulnerable to a disaster event (Gupta et al, 2016). There is significant room for improvement in response planning, as emergency management plans often lack disaster logistics or urban planning insights (Kovács and Spens, 2007; Tag-Eldeen, 2017). Additionally, even if a tool is not directly leveraged, the deliberate process of planning may still contribute to the actors' awareness of factors relevant to decision making (Latham and Yukl, 1975).

Informal mediums can also be leveraged; social media and crowd-sourcing, for example, can be used to gather information and achieve better disaster management outcomes, with some caveats. Crowd-sourced hazard identification or needs assessment is reliant on power, cellular service, factors related to the beneficiary population (e.g., owning or having access to a cell phone) and the individuals (e.g., wanting to help the effort over his/her own personal needs post-disaster) (Yang et al, 2014). For these reasons, this solution to the knowledge management problem has more potential for small disasters and disasters in affluent regions, during the recovery phase. A crowd-based system could aid recovery capability and speed the return to normal operations. Much of the investment, here, would be in developing a simple, user-friendly mobile application and educating the population. Offline data collection features could be useful during the

response phase, but only if individuals have downloaded the app in advance and are trained on its use.

Knowledge management investments include data collection and analysis, information management, review activities, and continuous learning. Pettit and Beresford's (2009) found two critical success factors played key roles in informing crisis decision making: *information management*, which included elements of strategic and enterprise resource planning, performance and utilization data, and system integration with partners and *technology utilization*, which encompassed innovation and adaption of information technology (IT) tools,. A commitment to organizational learning, specifically capturing, codifying, and transferring logistics knowledge, plays a role in sustaining performance and improving learning processes between response events (Van Wassenhove, 2006).

Time Pressures. Time pressures impact performance management and organizational learning in a number of ways, specifically with regards to reporting and evaluation. Humanitarian organizations often pursue a variety of learning activities during steady state, where there may be more time to undertake deliberate learning and review efforts. Pre-disaster collaboration lays the foundation for humanitarian organizations to meaningfully contribute to disaster relief efforts. Involvement in these efforts slows the pace of organizational learning, allowing time for deliberate reflection, codification and transfer of knowledge to humanitarian response processes (Argote, 2013). Proactive mechanisms may include preparedness workshops, training, exercises, outreach projects and the development of guides, checklists, processes or policy. Many organizations tend toward the adoption of standards – both internal and international – to

guide these activities (Larson and Foropon, 2018). Proactive learning activities may be internal to the organizations or conducted collaboratively with other assisting organizations or a high-risk community. However, these activities rarely have priority over daily operations, and so resources and attention may be limited. Furthermore, there are numerous barriers to retention, as response and preparedness skill sets gained in steady state these are perishable and thus require significant recurring use in order to maintain the desired level of readiness or proficiency.

During immediate response, practitioners must focus on the task at-hand, often leaving limited time left for reflection and reporting. The urgency of response does not often allow time for sufficient data collection or synthesis (Pedraza-Martinez and Van Wassenhove, 2016). Similarly, tight reporting deadlines may not provide enough time to adequately reflect before writing a report, performance outcomes may not yet be realized, or outcomes – and learning – may be confounded by numerous other factors. Secondary disasters, withdrawal or expenditure of critical resources, can draw additional attention from reporting and evaluation efforts, resulting in delays or early termination of these activities. Delays negatively impact the reliability and usefulness of the information provided, as cognition errors increase over time.

Humanitarian organizations typically conduct various assessment, evaluation and review activities during and after humanitarian operations. Retrospective reports (*learning documents*) are a standard part of redeployment and close-out, with varying degrees of collaboration, organizational emphasis, learning orientation, and resultant change. Reports may be used to record the timeline of disaster events, the actions of an assisting or assisted organization, or may provide assessment and evaluation, lessons, or

recommendations for future responses. When using documents for research, one must consider that “it was written for some specific purpose and some specific audience other than those of the case study being done... to achieve some other objectives” (Yin, 2009: 105). To this end, the present study utilizes two broad classifications of reports as *learning documents* – the *after-action report* and the *lessons learned report* – written for two unique purposes. After-action reports tend to be descriptive in nature, providing details of the disaster impact, response timelines, and a record of response actions. Conversely, lessons learned reports tend to be more prescriptive, learning-oriented, providing a critique of actions, and looking forward to generalize observations and lessons for improvement in future operations. Therefore, the label of a learning document is not semantic, but instead deliberate and indicative of an organization’s learning culture.

Coordination and Collaboration. The humanitarian operating environment draws a wide array of organizations and stakeholders. These stakeholders include the assisted parties, including the host national government, military, and civilian population; assisting parties, including humanitarian organizations, military organizations, international humanitarian aid networks; and donors and the media.

Conditions are highly dynamic and often politically charged, posing significant challenges to inter-agency coordination at all phases of the response cycle, with sub-optimal results for performance and learning (Oloruntoba, 2013). This effect is particularly noticeable in military-civil coordination. Military organizations generally provide unique supplementary capabilities during early response; however, military

involvement is not always welcome and can, in some circumstances, put civilian humanitarians at risk.

Resources are limited, so efforts to better focus or streamline an organization's humanitarian efforts are worthwhile. One benefit to collaboration is improved quality of demand information (e.g., anticipated needs assessment). There is potential, here, for generalizing or anticipating demand, as many large humanitarian organizations have decent demand estimates (e.g., for what 100,000 people need for one week after a flood) (Eftekhari et al, 2019). The most commonly needed items, regardless of disaster type, are water, medicine, chlorination tablets, tents, blankets, and protein sources (Kovács and Spens, 2007). However, these requirements may need to be customized to the community (e.g., due to cultural or religious restrictions). Better demand information helps to evaluate trade-offs in inventory investments. It is important to understand which items will be needed most urgently or with the highest levels of demand, enabling inventory management following a prioritization framework (Anupindi et al, 2012). Advanced demand information is complicated with incomplete and imperfect information. Early information is often inaccurate, but collaboration strategies can improve the quality of early information (e.g., Thonemann, 2002; Tan et al., 2007). Additionally, resource pooling (e.g., of money, expertise, equipment, supplies, or vehicles) for employment during relief efforts is not common between humanitarian organizations (Pedraza-Martinez and Van Wassenhove, 2016), despite obvious benefits in terms of cost savings and potential for faster response and improved ability to meet demand.

Social capital investments improve collaboration, information sharing, and response agility (Rüsch et al, 2019). These investments involve establishing relationships with key players (e.g., military, government, business, and other humanitarian organizations) and integrating into the community (Van Wassenhove, 2006). Furthermore, the gap between needs assessment and decision making is often underscored by a lack of trust between responding organizations (Darcy and Hofmann, 2003). More accurately, however, it is *swift trust*, the brand of trust that develops in condensed time frames with temporary teams. Dubey et al's (2017) study on swift trust and commitment empirically linked swift trust to commitment and supply chain coordination. Partnerships lead to information sharing, and a shared knowledge of the other organization's motivations and expectations (i.e., reduced behavioral uncertainty) which are critical enablers of swift trust (Ergun et al, 2014; Dubey et al, 2017; Tatham and Kovacs, 2010).

Different organizations have different expectations, needs and goals with respect to building inter-organizational relationships. In order for mutual trust to develop, all parties need to be satisfied by these interactions and engagements. Different types of engagements – goal-oriented or social – were preferred by different organizations, depending on the disaster phase, the organization type (e.g., local, national, or international; NGO, government, or military) and the relationship (i.e., communal or exchange-based) (Kovács and Spens, 2009; Heaslip et al, 2012; Rüsch et al, 2019). These dynamics impact how an organization approaches coordination, as well as collaborative performance and learning efforts.

We therefore assert that patterns exist in the topics reported by humanitarian practitioners in learning documents, as well as patterns in how those topics are connected. These patterns are impacted by humanitarian setting, publishing organization, and document label:

RQ1: *What practice and performance topics are included in humanitarian reports, and how is inclusion impacted by other factors?*

RQ2: *How do practitioners relate organization practice to performance, and how are these associations impacted by other factors?*

4.3 Methodology

The present study follows a cumulative case study design, which utilizes statistical document analysis and exploratory interviews. The statistical analysis has two components: (1) testing of log-linear models to determine patterns of inclusion, and (2) proportional analysis of specific practice/performance ties. Interviews are used to supplement the statistical analysis, providing contextual insights and general trends.

Figure 7, the process flow diagram, outlines the research design.

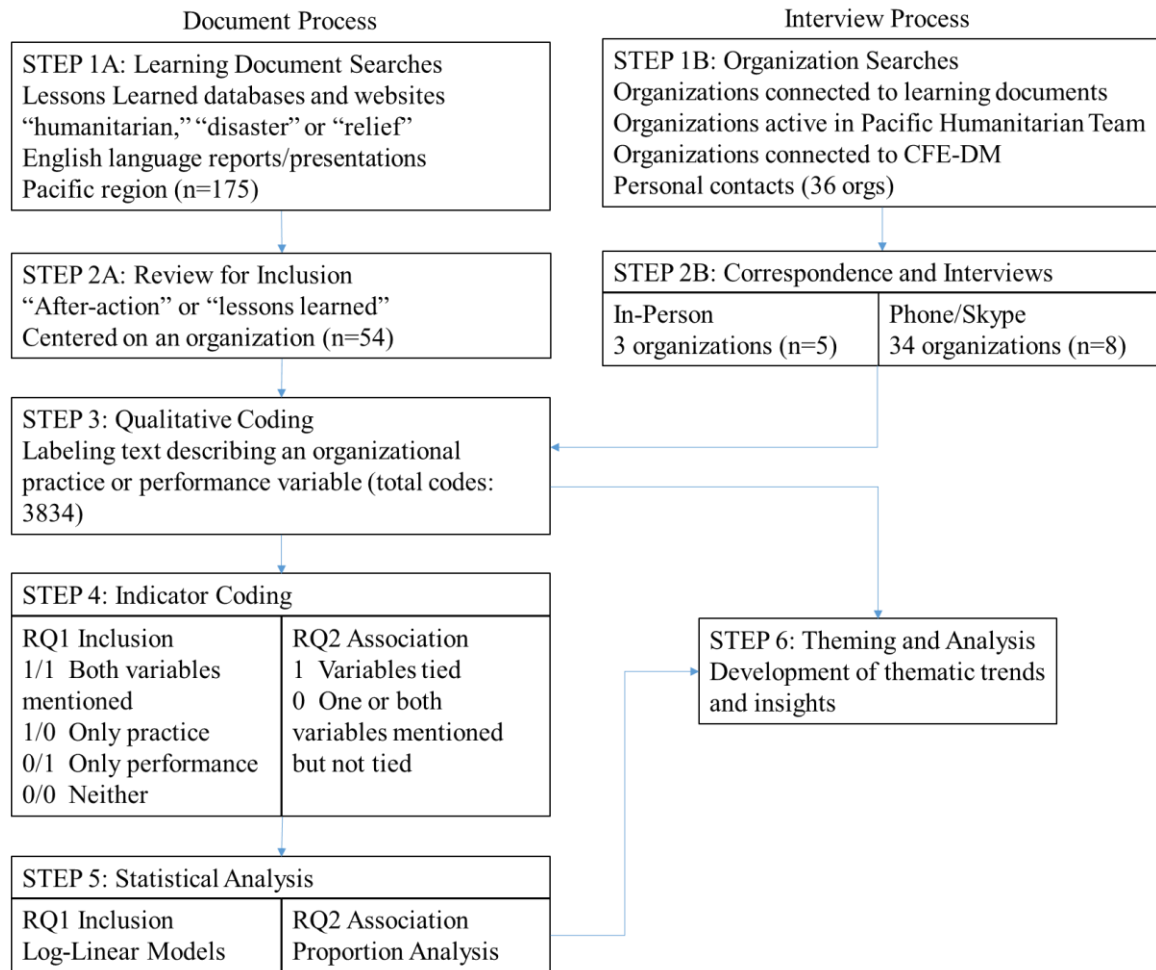


Figure 7. Cumulative Case Study Process Flow Diagram

4.3.1 Analysis Method

GAO (1990) defines the cumulative case study as one that brings together findings from many case studies to answer an evaluation question, whether descriptive, normative, or cause-and-effect. These cases can be collected from several locations at varying times, for the purpose of generalization or comparison (Davey, 1990). Research designs consisting of multiple case studies may be preferred for the purpose of replication, or for understanding factors that allowed for successful outcomes in one case, but less successful outcomes in another (Yin, 2009). Cumulative case studies are a form

of secondary analysis, in that it is “the re-analysis of data for the purpose of answering the original research question with better statistical techniques or answering new questions with old data” (Glass, 1976: 3).

The cumulative case study process follows the process of singular case studies, with additional cross-case analysis. This process has six basic steps: (a) defining the unit of analysis; (b) identifying the case search strategy and case sources; (c) case search and selection; (d) checklist development; (e) checklist application to the cases; and (f) data analysis and interpretation. This process differs from primary case research with the addition of techniques to ensure comparability and quality for aggregation. This includes the use of case surveys and backfill techniques (Davey, 1990). The process outlined in Berger (1983) for a case survey distills each case study into a survey-like set of discrete identifiers for statistical analysis. The case analyst answers a closed-ended set of questions regarding each case. This method is systematic, reliant on existing knowledge, enables the application of statistical techniques, and may then be used for generalization. Backfill techniques, such as interviews, may be used to supplement or to provide additional insight (e.g., qualitative themes) or missing information.

Triangulation through the use of different data sources, investigators, theories, or methods helps to mitigate some concerns with any singular approach (Denzin, 2006). This study triangulates methods, utilizing interviews as well as a case survey of learning documents for statistical analysis. Case studies often use documents as stable, unobtrusive data and reference material. Documents can also demonstrate access or publishing bias and reflect reporting biases of the author. Conversely, interviews are used for the development of qualitative themes to interpret and assess the statistical

findings and provide insight into complex mechanisms and behaviors. While interviews are beneficial for targeted inquiry and for obtaining insight into perceived explanations and inference, interviews may be biased due to the research design, the interview subject's recall or response to the interviewer. Utilizing both approaches mitigates bias (Yin, 2009). Additional concerns with cumulative case study methods include determining a sufficient number of case studies, establishing case validity and inter-analyst reliability, evaluating case quality, and missing data problems (Yin, 2009; Berger, 1983). These risks have been mitigated by increasing the sample size and triangulating. Additionally, a sub-sample was qualitatively coded by a second researcher, achieving an inter-rater reliability rating of over 90 percent.

Interview Methods. Interview methods provide access people, their behavior, and the context and meaning behind that behavior (Seidman, 1998). These methods are appropriate when pursuing research questions related to experiences, motives, opinions, complex events or social processes; when exploring how and why processes or events unfold over time; or “when you need to know what something feels like or how it works from the inside” (Rubin and Rubin, 2012: 3).

In the present study, semi-structured interviews followed a set of questions (see Appendix B.1), which allowed for divergence with more conversational questions to provide additional detail or clarification. Yin (2009) described interviews as verbal reports, subject to bias due to recall and articulation. This was less of a concern for these interviews, as the interview questions were more general, in nature, examining trends and impressions, more than specific examples or events.

Interview subjects were diverse, including individuals with experience across a range of military and civilian humanitarian operations, in dynamic post-response settings and in steady-state engagements. Many interview subjects had experience working in both organizations and settings, and were able to provide differentiating insights. Sample characteristics are discussed further in section 4.3.2.

Of the thirteen interviews, five were conducted in-person, seven via phone and one via Skype. Individuals were read an approved statement and ensured of confidentiality. They also provided consent for the interview and to be recorded for the purposes of transcription. In-person interviews were not recorded due to security restrictions in the interview locations; however, thorough notes were taken and transcribed following the same format. Preliminary transcription of recorded interviews was accomplished using NVivo transcription services, and then validated by the interviewer and interviewee.

Transcripts were qualitatively coded using the NVivo software package. Sections of text were tagged with variable codes for each of the fourteen humanitarian operations management practices and three categories of performance outcomes of interest. These are described in the variables section 4.3.3., Table 7. The interview transcript codes were not included in the statistical document analysis but were instead used to align document ties with interview insights and themes.

Statistical Document Analysis. Learning documents were qualitatively coded in the same way, before applying an indicator coding scheme for statistical analysis. The sample includes a total of 3834 codes, across all variables and all documents. A sub-

sample was coded by a second researcher, which achieved an inter-rater agreement rating over 90 percent.

The preliminary analysis utilized raw counts for each of these practice and performance variables. However, raw counts are biased by a number of factors, to include repetition and duplication in longer reports. Additionally, a higher count does not necessarily indicate statistical significance. To minimize the effect of this duplication and provide a more reliable analysis, the results from each report were distilled down to a series of discrete variables, following the case survey approach. Each of the 54 reports was then examined as a set of 42 bivariate practice-performance pairs, which were coded using an indicator coding scheme. As a result of the indicator coding scheme, this data set is configured as a set of discrete (i.e., countable) independent and dependent variables, which have nominal levels (i.e., no ordering effect). Categorical data behaves differently than continuous data and therefore requires different analytical tools (Schubert Kabban, 2019a).

The foundational tool for categorical analysis is the contingency table with a specified number of rows and columns. Depending on the configuration and sampling procedures, traditional 2-way tables provide counts or probabilities, as well as the conditional, joint and marginal distributions of variables. Further analysis can be accomplished with 3-way tables, which include an additional layering variable. Contingency tables are commonly used in medical research and in social sciences, to provide for the cross-classification of variables and comparisons across demographic or clinical groups (Lewis-Beck, 2003).

Contingency tables are used for two common inferences: (1) testing for independence and association between variables, and (2) comparing the probability of events, using relative risk, odds ratios, or difference in proportions (Schubert Kabban, 2019b). The present study leverages contingency tables for both of these purposes. The first component of the statistical document analysis, testing log-linear association and independence models, is used to determine how practice and performance topics are included or excluded from learning documents, according to the various document characteristics. The second component is a proportional analysis using the relative risk, which describes how documents with specific traits may be more or less likely to demonstrate connections (*ties*) between practice and performance topics.

Log-Linear Model Testing. To address the first research question regarding the topics discussed in the learning documents (*patterns of inclusion*), a series of 3-way contingency tables were used to test seven log-linear models. Log-linear models are generalized linear models using the log-linking function for a Poisson response. Log-linear models are methodologically appropriate when all independent and dependent variables are discrete, and the desired outcome is a unified model of association and interaction patterns (Agresti, 2013). The model does not distinguish between response and explanatory variables, treating them jointly as responses to model the cell value for the combinations of their levels.

Following the conventional hierarchical log-linear modeling strategy described in Agresti (2013), the first test was for goodness of fit with the complete independence model, then a variety of two-way interaction terms, and, finally, a three-way marginal independence model. Various hierarchical models are useful because this study is

designed to ascertain the nature of associations, i.e., the “underlying *patterns* or *structures* of association,” not whether an association exists (Wong, 2010: 9). The most general is the mutual independence model (0), wherein all variables are independent. The next level are the joint models (models 1-3), where one variable is jointly independent of the other two. Then, conditional models (models 4-6), with two variables conditionally independent given a fixed level of the other variable, and, finally, the marginal or homogenous model (model 7), in which two variables are independent for each of the levels of the third. Hierarchy relationships are displayed in Figure 8, with key equations and descriptions in Table 6.

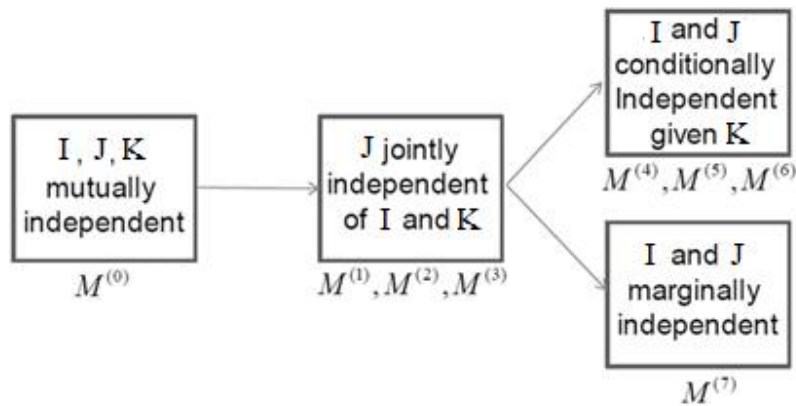


Figure 8. Hierarchy of Log-Linear Models

Table 6. Description of Log-Linear Models

Model	Expected Cell Counts	Log-Linear Equation	Description	Short Description
0	$\frac{n_{i++}n_{+j+}n_{++k}}{n_{+++}^2}$	$\ln(n_{+++}) + \ln(p_{i++}) + \ln(p_{+j+}) + \ln(p_{++k})$ $df=IJK-I-J-K+2=4$	Main effects; no 2- or 3-way interactions	"Independence"
1	$\frac{n_{i++}n_{+jk}}{n_{+++}}$	$\ln(n_{+++}) + \ln(p_{i++}) + \ln(p_{+jk})$ $df=(I-1)(JK-1)=3$	One main effects; one 2-way interaction	"Joint (Practice)"
2	$\frac{n_{+j+}n_{i+k}}{n_{+++}}$	$\ln(n_{+++}) + \ln(p_{+j+}) + \ln(p_{i+k})$ $df=(J-1)(IK-1)=3$	One main effects; one 2-way interaction	"Joint (Characteristic)"
3	$\frac{n_{++k}n_{ij+}}{n_{+++}}$	$\ln(n_{+++}) + \ln(p_{++k}) + \ln(p_{ij+})$ $df=(K-1)(IJ-1)=3$	One main effects; one 2-way interaction	"Joint (Performance)"
4	$\frac{n_{i+k}n_{+jk}}{n_{++k}}$	$\ln(n_{+++}) + \ln(p_{i+k}) + \ln(p_{+jk}) - \ln(p_{++k})$ $df=(I-1)(J-1)K=2$	One main effects; interaction of other factors with that one	"Conditional (Performance)"
5	$\frac{n_{ij+}n_{+jk}}{n_{+j+}}$	$\ln(n_{+++}) + \ln(p_{ij+}) + \ln(p_{+jk}) - \ln(p_{+j+})$ $df=(I-1)(K-1)J=2$	One main effects; interaction of other factors with that one	"Conditional (Characteristic)"
6	$\frac{n_{ij+}n_{i+k}}{n_{i++}}$	$\ln(n_{+++}) + \ln(p_{ij+}) + \ln(p_{i+k}) - \ln(p_{i++})$ $df=(J-1)(K-1)I=2$	One main effects; interaction of other factors with that one	"Conditional (Practice)"
7	Iterative	$\ln(\mu_{111}) + \ln(\mu_{ij+}) + \ln(\mu_{11k}) + \ln(\mu_{i++}) - \ln(\mu_{111}) - \ln(\mu_{1j1}) - \ln(\mu_{11k}) - \ln(\mu_{ijk}) = 0$ $df=(J-1)(K-1)(I-1)=1$	One 3-way interaction; three 2-way interactions	"Marginal"

Where I =rows (practice variable), J =layers (document characteristic) and K =columns (performance); n is the count of a cell within the table; p is the cell probability; + indicates a marginal total for that I , J , and/or K variable; and df is the degree of freedom utilized for tests of that model.

Following a case survey approach, each learning document was described using a table of fourteen practice and three performance variables. Each practice and performance variable was represented as a Bernoulli trial, in which inclusion in a

document was a “success” and exclusion was a “failure.” For a bivariate pair, this was represented by the following indicator coding scheme:

1/1 both practice and performance variables included
 0/0 neither variable included
 1/0 only practice variable included
 0/1 only performance variable included

These singular trials were then aggregated across all 54 learning documents into a 3-way table, with the document characteristic as a layering factor. An example, provided in Table 7, describes how these cell counts were then utilized to find marginal totals, where I =rows (practice variable), J =layers (document characteristic) and K =columns (performance) with consolidation over a variable demonstrated by the (+) notation. These marginal totals were used for calculating expected cell counts and log-linear equations described in Table 6.

Table 7. Log-Linear Coding Example

		Innovation	
Setting	Closure	1	0
Dynamic	1	23	5
	0	7	3
Steady	1	10	2
	0	3	1

	n	n _{ij+}	n _{+jk}	n _{i+k}	n _{ii++}	n _{+j+}	n _{++k}	n ₊₊₊
Dyn/1/1	23	28	30	33	40	38	43	54

Goodness of fit for various models was tested using G^2 and χ^2 test statistics. The best fit model was selected by, first, identifying models with good χ^2 p-values, then comparing the G^2 statistics in relation to the critical value for the difference in degrees of

freedom. In the event that multiple models performed well, preference was given to the more advanced hierarchical model. If no model performed better than chance (0.5), then the complete independence model (0) was selected. Test statistic formulas are provided below.

$$X^2 = \sum_{i=1}^I \sum_{j=1}^J \sum_{k=1}^K \frac{(n_{ijk} - \hat{\mu}_{ijk}^{(m)})^2}{\hat{\mu}_{ijk}^{(m)}} \quad (8)$$

Where (m) is the model of interest, n is the observed cell count, and $\hat{\mu}$ is the expected value for that cell.

$$G^2 = 2 \sum_{i=1}^I \sum_{j=1}^J \sum_{k=1}^K n_{ijk} \ln \frac{n_{ijk}}{\hat{\mu}_{ijk}^{(m)}} \quad (9)$$

Proportional Analysis. Similarly, proportional analysis is also used primarily in medical research, to compare the likelihood of an outcome between groups in cohort studies and clinical trials (Zhang and Yu, 1998). The second research question analyzes ties (*patterns of association*) between practices and performance variables. This is accomplished in the present study, by using relative risk to compare the likelihood of success (a tie between a practice and performance variable) for a layering document characteristic. The relative risk statistic uses the top row as the referent category. Therefore, a relative risk statistic over one indicates that category listed in the top row is more likely to demonstrate “success” than the one in the bottom row; conversely, a statistic below one indicates that the top category is less likely than the bottom category (Schubert Kabban, 2019b). Conversely, when the relative risk statistic is equal to one, or when the confidence interval includes one, that indicates an equal probability of a tie being present or not being present, regardless of the document characteristic (i.e., no better than chance). Calculations were accomplished in Excel. A relative risk result of

zero or a “#DIV/0!” error (positively infinite relative risk) were indicative of cases when there were sampling zeros for one category of the layering variable but not the other.

The relative risk statistic was found using the formula below, wherein n is the count of a specified cell within the table and marginal totals for a row variable (document characteristic) is denoted by (+).

$$RR = \frac{n_{11}/n_{1+}}{n_{21}/n_{2+}} = \frac{n_{11} n_{2+}}{n_{21} n_{1+}} \quad (10)$$

Upper and lower confidence bounds were found using the following, for an alpha (α) value of 0.05:

$$\log RR \pm z_{\alpha/2} \sqrt{\frac{p_{12}}{p_{11}n_{1+}} + \frac{p_{22}}{p_{21}n_{2+}}} \quad (11)$$

Each learning document was described using a table of fourteen practice and three performance variables. A “tie” was established when text referring to a practice variable overlapped with text referring to a performance variable, indicating that the author perceives a link (e.g., association or causal) between the two variables. Each variable was represented as a Bernoulli trial, in which a tie between variables was “success” and lack of such a tie was “failure.” For this research question, a condensed version of the indicator coding was used to represent each of the 42 bivariate pairs:

- 1: practice and performance variables were tied
- 0: one or both variables were included, but not tied
- N/A: neither variable included

These results were then aggregated all 54 learning documents into a 3-way table, with the document characteristic as a layering factor. An example, provided in Table 8, shows the aggregated coding for one bivariate pair and layering factor, along with relative risk point

estimate and confidence lower and upper bounds. In this example, the bounds overlapped 1, indicating that after-action reports were no more or less likely than lessons learned reports to include a connection between an organization's closure practices and innovation performance.

Table 8. Proportional Analysis Coding Example

Closure - Innovation	N/A	1	0	(1,0) Total
AA Reports	5	1	30	31
LL Reports	3	3	12	15
Total	8	4	42	46
RR (LB,UB)	0.161	0.018	1.448	"Chance"

4.3.2 Sample Characteristics

This study is focused on the Pacific region, due to the frequency of humanitarian operations and the numerous concerted efforts that the Pacific humanitarian community is currently undertaking to improve readiness and resilience. The region is exceedingly vulnerable to climate change and natural hazards, making disaster risk management critical. Additionally, the United States Indo-Pacific Command is uniquely concerned with foreign humanitarian assistance, with related priorities and goals are featured prominently in the command's 2019 strategy report (Department of Defense, 2019).

This cumulative case study draws from 29 humanitarian operations and over twenty-three organizations across a ten-year period. For the purpose of this study, the "Pacific humanitarian community" is inclusive of all agencies and organizations that work within the humanitarian space, including military, government, and non-government organizations engaged in humanitarian projects during steady state (e.g.,

disaster risk reduction, preparation) as well as dynamic, post-disaster response. The sample selection process and subsequent analysis is described in Figure 6. Table 9 provides a summary of the breadth represented by the 54 learning documents and thirteen expert interview subjects.

Table 9. Cumulative Case Study Sample Summary

Learning Documents	Total n (%)	Interviews	Total n (%)
<i>Label</i>		<i>Organization Experience</i>	
After-Action Report	36 (66.7%)	Military Only	5 (38%)
Lessons Learned Report	18 (33.3%)	Civilian Only	5 (38%)
<i>Organization</i>		Both	3 (23%)
Military	46 (85.2%)	<i>Setting Experience</i>	
Civilian	8 (14.8%)	Dynamic Only	3 (23%)
<i>Setting</i>		Steady Only	3 (23%)
Dynamic	38 (70.4%)	Both	7 (54%)
Steady	16 (29.6%)		
<i>Year</i>			
2010	5 (9.3%)		
2011	11 (20.4%)		
2012	3 (5.6%)		
2013	9 (16.7%)		
2014	4 (7.4%)		
2015	15 (27.8%)		
2016	1 (1.9%)		
2017	2 (3.7%)		
2018	1 (1.9%)		
2019	3 (5.6%)		

A total of 175 learning documents were sourced from a wide variety of civilian humanitarian websites (e.g., the Overseas Development Institute, International Federation of the Red Cross/Crescent) as well as United States Department of Defense organizations with a humanitarian focus (e.g., the Center for Excellence in Disaster Management, CFE-DM) and US military lessons learned platforms. These documents described the organizational practices and resultant performance in response to, or preparation for, disaster response throughout the Pacific region from 2010 to 2019. For the purpose of this study, only after action and lessons learned reports were included; other labels (e.g., comprehensive case studies) were excluded as these documents reflect a different approach to learning. This resulted in a final sample of 54 reports.

The process of selecting interview subjects was similarly systematic. Initial solicitation messages were sent to a wide array of organizations, utilizing personal contacts (primarily United States Air Force logisticians), CFE-DM and their network, and additional civilian organizations found through the Pacific Humanitarian Team website and regional humanitarian partnerships and conferences. All interview subjects had field experience, though not always in their current position or location. The number of interviews per organization were limited, with duplication only permitted when an additional interview would provide a substantially different perspective or breadth of experience. Most interviews were conducted via phone; however, a visit to Hawaii, where many regional headquarters are located, enabled in-person follow-ups and interviews.

4.3.3 Variables

Numerous best practices and key factor analyses have been conducted, with a recent push for more deliberate management of humanitarian supply chains (Starr and Van Wassenhove, 2014). The practices considered in this study are drawn from academic literature, the international humanitarian community, and the Pacific regional humanitarian community; these practice variables are described in Table 10. Over 200 works were consulted in the development of this list of critical humanitarian practices. First, prominent works were consulted (e.g., Van Wassenhove, 2006; Balci and Beamon, 2008; Altay and Green, 2006; Kovacs and Spens, 2011; Pettit and Beresford, 2009; Jahre et al, 2009). Then, specialized peer-reviewed journals (e.g., Journal of Humanitarian Logistics and Supply Chain Management). Finally, the websites of various humanitarian organizations were consulted for best practice guides, both in the global sphere (e.g., UNOCHA, Organisation for Economic Co-operation and Development, and Relief Web) and in the Pacific region (e.g., Pacific Community and Partnership for a Resilient Pacific, Regional Consulting Group Pacific).

Additionally, this study also utilizes three document characteristics as layering variables. While there are a multitude of differentiating features of these documents, the characteristics of interest are the document label (*after-action report* or *lessons learned report*), publishing organization (*military* or *civilian*), and humanitarian setting (*dynamic post-disaster state* or *steady state*).

Table 10. Cumulative Case Study Variables

Performance		Docs	Codes
Innovation	Outcomes related to demonstrations of organizational learning, change and growth; experimentation and policy development	42 (78%)	95 (2.5%)
Primary	Outcomes related to primary humanitarian mission fulfilment; providing the right supplies/services to the affected population, at the right place, at the right time, and in the right quantities; logistical/operational effectiveness	48 (89%)	500 (13%)
Secondary	Other outcomes related to assisted/assisting stakeholder priorities and requirements (e.g., equity outcomes, protection, accountability)	54 (100%)	939 (24.5%)
Practice			
Closure	Redeployment planning and execution; project closeout; termination of mission set or transition to other organization	18 (33%)	31 (0.8%)
Communications and Information Technology	Practices related to the establishment, sourcing and use of communications systems, equipment, networks and platforms; includes radios, phones, mobile apps, data services, All Partners Access Network (APAN), email and other classified or unclassified collaborative tools	43 (80%)	142 (3.7%)
Coordination and Collaboration	General practices related to establishing and solidifying productive relationships with various assisted/assisting organizations; includes efforts that contribute to cultural understanding, goal alignment, resource pooling, integration, and standardization	49 (91%)	535 (14%)
Disaster Risk Reduction	Engagement in partnered activities aimed to prevent or mitigate negative disaster outcomes in a vulnerable community or for a vulnerable population	13 (24%)	52 (0.1%)
Human Resource Management	Practices related to establishing and employing an effective staff; to include technical training, local expertise and inter/cross-cultural understanding, beddown, manning and team composition	52 (96%)	389 (10.1%)
Inventory Management	Practices related to sourcing and management of aid inventory, including donated goods, and their suitability for use	29 (54%)	79 (2.1%)
Knowledge Management	Practices related to the handling, accessibility and flow of information, including tracking, accounting and reporting actions	48 (89%)	206 (5.4%)
Leadership and Org. Structure	Employment and understanding of key relationships, chain of command, and organizational structure	33 (61%)	88 (2.3%)
Local Preparation	Engagement in partnered activities aimed to improve a community's early disaster response or post-disaster resilience, or the development of related capabilities	27 (50%)	139 (3.6%)
Rapid Response	Expedient use of rapidly deployable resources, to include equipment, inventory, financial resources, and personnel	18 (33%)	49 (1.3%)
Resource Management	Practices related to sourcing and employment of organic resources and capabilities, including equipment and funding; excludes transportation assets (see "transportation and distribution"), communications assets (see "Communications and Information Technology"), and personnel (see "Human Resource Management")	45 (83%)	179 (4.7%)
Risk and Needs Assessment	Practices related to the gathering of risk and needs information (e.g., through site surveys or use of intelligence assets) and the development of priority information requirements	40 (74%)	143 (3.8%)
Strategic Planning and Policy	The establishment and employment of clear organizational goals and performance criteria, areas of operation, rules of operation in the local environment, and supporting doctrine and policy	40 (74%)	122 (3.2%)
Transportation and Distribution	The sourcing and use of transportation assets suitable to the local environment; the establishment of port operations, distribution networks and distribution rules regarding the prioritization of aid and beneficiaries	34 (63%)	146 (3.8%)

4.4 Results and Analysis

In the present study, two main research questions are examined. The first is related to how humanitarian practitioners include practice and performance topics in organizational learning documents. Log-linear models describe independence relationships between the variables, providing insight into the impact of label, organization and setting. Additionally, practitioner inclusion of secondary performance topics is pervasive, highlighting the gap that exists between the field and academia. Interviews provided insight into how the individual's *theory in use* conflicts with organizational learning goals, observed as codification gaps in the log-linear models (*missingness*). This may be due to a variety of factors, to include suppression of information to protect the self, or internalization of information to protect the organization or status quo.

The second research question examines how humanitarian practitioners connect organizational practice with performance outcomes. Proportional analysis demonstrates how the reporting of practice and performance ties varies according to label, organization and setting. Additionally, two unique ties are explored in more detail with proportional analysis, text from the learning documents, and interview themes. These pairs, *knowledge management-innovation* and *organization-innovation*, provide insight into organizational learning mechanisms, their perceived effectiveness, and how this differs between military and civilian humanitarian organizations.

4.4.1 RQ1: Practitioner Inclusion of Practice and Performance Topics

Each of the three document characteristics of interest – label, organization and setting – were significant in explaining some of the variation in which practices and

performance outcomes were discussed in the learning documents. *Label* had the highest number of Model 5 associations (11) – conditional on the document characteristic – and *organization* and *setting* each had ten such associations. Table 11 provides the best fit models for each variable pair and document characteristic.

Document Label. Of the 42 bivariate pairs, there were eleven statistically significant associations related to the document label. All eleven were significant for Model 5, conditional independence given the label. One association, *resource management-innovation performance-label*, was unique to document label.

Publishing Organization. There were fifteen significant associations with respect to publishing organization. Of these, ten were significant for Model 5, conditional independence given the characteristic, with one of those being unique, *local preparation-primary performance-organization*. The additional five significant associations were Model 4 relationships, conditional independence given the performance type. Two of these associations (*local preparation-innovation performance-organization* and *human resource management-innovation performance-organization*) were unique to organization type. Notably, reports generally described the actions of both military and civilian organizations. This is indicative of a collaboration-heavy environment and a small international humanitarian community. There was, however, a small subset of military after-action reports that only included the actions of that specific organization.

Humanitarian Setting. Setting had the highest number of significant associations: 19. Of these, ten were significant for Model 5, with none being unique to setting. There were eight significant associations for Model 4, five of which were unique (*leadership and organizational structure-all performance categories-setting*, and *rapid*

response-primary and secondary performance-setting). The remaining association was significant for a Model 1 relationship, wherein rapid response was jointly independent from innovation performance and setting.

Table 11. Cumulative Case Study Log-Linear Model Inclusion Results

Document Label	Innovation	Primary	Secondary
<i>Closure</i>	Independent	Independent	Independent
<i>Communications/IT Mgt.</i>	Independent	Marginal	Independent
<i>Coordination/Collaboration</i>	Cond. (Label)**	Cond. (Label)***	Cond. (Label)
<i>Disaster Risk Reduction</i>	Cond. (Label)	Independent	Independent
<i>Human Resource Mgt.</i>	Cond. (Label)	Cond. (Label)**	Cond. (Label)*
<i>Inventory Mgt.</i>	Cond. (Label)	Cond. (Label)	Independent
<i>Knowledge Mgt.</i>	Cond. (Label)**	Independent	Cond. (Label)
<i>Leadership/Organization Structure</i>	Marginal	Cond. (Label)	Independent
<i>Local Preparation</i>	Joint (Practice)	Cond. (Label)	Cond. (Perf.)
<i>Rapid Response</i>	Cond. (Label)	Cond. (Label)	Independent
<i>Resource Mgt.</i>	Cond. (Label)*	Cond. (Label)*	Independent
<i>Risk/Needs Assessment</i>	Cond. (Label)*	Cond. (Label)**	Independent
<i>Strategic Planning/Policy</i>	Cond. (Label)**	Cond. (Label)**	Independent
<i>Transportation/Distribution</i>	Cond. (Label)	Cond. (Label)	Independent
Publishing Organization	Innovation	Primary	Secondary
<i>Closure</i>	Cond. (Perf.)	Cond. (Perf.)	Cond. (Perf.)
<i>Communications/IT Mgt.</i>	Cond. (Perf.)	Cond. (Practice)	Cond. (Perf.)
<i>Coordination/Collaboration</i>	Cond. (Org.)**	Cond. (Org.)***	Cond. (Org.)
<i>Disaster Risk Reduction</i>	Cond. (Practice)*	Cond. (Practice)*	Cond. (Practice)*
<i>Human Resource Mgt.</i>	Cond. (Practice)*	Cond. (Org.)	Cond. (Org.)*
<i>Inventory Mgt.</i>	Cond. (Org.)	Cond. (Org.)	Cond. (Perf.)
<i>Knowledge Mgt.</i>	Cond. (Org.)*	Cond. (Perf.)	Cond. (Org.)
<i>Leadership/Organization Structure</i>	Cond. (Org.)	Cond. (Org.)	Cond. (Perf.)
<i>Local Preparation</i>	Cond. (Practice)*	Cond. (Org.)*	Cond. (Perf.)
<i>Rapid Response</i>	Cond. (Org.)	Cond. (Org.)	Cond. (Perf.)
<i>Resource Mgt.</i>	Cond. (Org.)	Cond. (Org.)*	Cond. (Perf.)
<i>Risk/Needs Assessment</i>	Cond. (Org.)*	Cond. (Org.)***	Cond. (Perf.)
<i>Strategic Planning/Policy</i>	Cond. (Org.)**	Cond. (Org.)*	Cond. (Perf.)
<i>Transportation/Distribution</i>	Cond. (Org.)	Cond. (Org.)	Cond. (Perf.)

P-value significance: '***' 0.001 '**' 0.01 '*' 0.05

<i>Humanitarian Setting</i>	<i>Innovation</i>	<i>Primary</i>	<i>Secondary</i>
<i>Closure</i>	Cond. (Practice)	Cond. (Practice)	Cond. (Practice)
<i>Communications/IT Mgt.</i>	Independent	Cond. (Setting)	Independent
<i>Coordination/Collaboration</i>	Cond. (Setting)**	Cond. (Setting)***	Cond. (Setting)
<i>Disaster Risk Reduction</i>	Cond. (Practice)*	Cond. (Practice)*	Cond. (Practice)*
<i>Human Resource Mgt.</i>	Cond. (Practice)	Cond. (Setting)*	Cond. (Setting)**
<i>Inventory Mgt.</i>	Cond. (Setting)	Cond. (Setting)	Independent
<i>Knowledge Mgt.</i>	Cond. (Setting)*	Independent	Cond. (Setting)
<i>Leadership/Organization Structure</i>	Cond. (Practice)**	Cond. (Practice)**	Cond. (Practice)**
<i>Local Preparation</i>	Cond. (Setting)	Cond. (Setting)	Independent
<i>Rapid Response</i>	Joint (Practice)**	Cond. (Practice)*	Cond. (Practice)*
<i>Resource Mgt.</i>	Cond. (Setting)	Cond. (Setting)*	Independent
<i>Risk/Needs Assessment</i>	Cond. (Setting)*	Cond. (Setting)**	Independent
<i>Strategic Planning/Policy</i>	Cond. (Setting)**	Cond. (Setting)**	Independent
<i>Transportation/Distribution</i>	Cond. (Setting)	Cond. (Setting)	Independent

P-value significance: ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05

Secondary performance is pervasive. These performance outcomes are included more often in the learning documents, regardless of document characteristic, and in a way that differs significantly from the other two performance variables. Preliminary count data showed that secondary performance had the highest number of references across all variables, accounting for 24.5% of the total codes; additionally, secondary performance was the only variable that was discussed in all 54 reports. This was supported by log-linear testing, wherein secondary performance only had seven statistically significant associations across all three document characteristics, and seventeen associations for which the complete independence model was the best fit.

Furthermore, innovation and primary performance tested similarly and significantly different from secondary performance. Innovation and primary performance were in agreement for 69% of best fit models, with 9-10 statistically significant practices for each document characteristic. This is nearly double the comparable statistics for

innovation and secondary performance (38% agreement, 5-6 practices for each) and primary-secondary performance (36% agreement, 4-6 practices for each).

The specific secondary performance outcomes included in the reports demonstrated a wide breadth of concerns, both internal and external to the publishing organization. Common secondary performance topics included security, equity in distribution, and aid appropriateness. Secondary measures can more comprehensively address the impact of humanitarian operations, and the breadth demonstrates that organizations are attempting to avoid the strategic messaging trap wherein they track and report primary performance outcomes but “lack publically-digestible (sic) statistics... to express how people and the [local government] were assisted in ‘real’ terms” (Document 46, military, dynamic, AAR). A common concern here is that, “when organizations tend to focus on, for example, the financial metrics, because it’s easy, then they might unconsciously or unintentionally neglect some of the other outcomes just because it’s hard to measure and manage” (Interview 1, civilian, dynamic). Notably, financial outcomes were not mentioned in any of the sample reports. This may be due to the document label (i.e., with financial reporting outside of the reports’ scope).

Exclusion due to lack of trust. “Missingness” impacts these results in a nontrivial way. As the research design did not allow for structural zeros, all zeros were related to sampling and the reporting and presentation of imperfect information. Some topics may be excluded unintentionally due to cognition errors and time effects, and some topics were alluded to but not explicitly referenced. One practitioner asserted that information regarding perceived causal relationships may be excluded from early reports because it is difficult to attribute improved performance to any single practice, “if we see

we might be getting better at something, is it because of lighter helicopters, better technology, or some other practice?” (Interview 12, varied background, varied settings).

Publication bias may favor successful examples in cumulative case studies (Berger, 1983); interviews similarly suggested a bias toward positive outcomes, at the expense of potentially more substantial and useful criticisms. Reports may be biased against reporting negative observations for a number of reasons, the most notable of which are deliberate exclusion in order to *suppress* information, thereby protecting the author, and exclusion in order to keep information *internalized*, protecting the organization or key relationships. These effects are anecdotally believed to be most significant with topics related to *leadership and organizational structure*, and in civilian organizations.

Suppression. In cases where information is suppressed, it may be in order to avoid personal criticism. In one interview, the subject stated that “Saying that something didn’t work assumes that there is some kind of blame that needs to be assigned” and that when no one wants to take it on, it often falls to the person who mentioned the issue (Interview 12, varied background, varied settings). This can be perceived as poor work performance; “the real challenge is that you have a career path, so your actions and your performance impact your next position” (Interview 8, varied background, varied settings).

Internalization. Alternately, practitioners may neglect to report the negative in order to keep this information internalized at a lower level, protecting the organization or its key relationships. One interview subject observed this trend as a way to protect the small team within the larger organization, its network, and stakeholders, saying you are

always “reporting back to your funders or donors” (Interview 1, civilian, dynamic).

However, the interviewee continued, describing the importance of organizational culture in overcoming this fear, “it’s sometimes difficult to make the sort of changes that are really necessary... It depends on the organization, if they’re really committed and the people are really committed to learning and improvement.”

The type of reporting has an impact, as well, as was demonstrated by the effect of *document label*. Different learning mechanisms have different strengths and weaknesses, and are best used in concert. One interview subject explored the unique dynamic that exists with reports and evaluations that include an external party or audience. In such activities, the act of assigning blame could be harmful to an inter-organizational relationship with a partner, or that it could create a negative perception of the organization, as one that does not accept responsibility but instead places blame on others. In this interview, the subject described how this leads to a preference for internal improvement of one organization at the expense of larger system-wide improvements, stating...

People won’t admit mistakes or call out their friends. In assessments, evaluations, (and) interviews, bias exists, where they will tell the good things but not the bad things in order to avoid assigning blame.... But with other assessments you can be more honest because anything bad will stay in-house in order for you to improve your organization. But you wouldn’t share outside of that, and sometimes you wouldn’t want to. Not all assessments are geared toward your specific purpose. Is it to help you?

Will it help differentiate your organization from another? (Interview 13, military, varied settings)

Interview insights also suggest that civilian organizations may prefer to keep more critical insights, evaluations and critiques internal, as one interview subject stated, humanitarian organizations...

All have their own desires. One may have an existing setup and community ties to support their own identified needs, and they don't need to share that information or those connections. They all compete, economically, and in terms of service delivery. There is an aspect of altruism, yes, but all in competition still... There is not a strong desire to share resources or information, and sharing lessons learned in that environment makes [other organizations] stronger as well (Interview 13, military, varied settings).

4.4.2 RQ2: Practitioner Association of Practice and Performance Topics

Proportional analysis of the relative risk provided insight into how practice variables are associated with performance variables, and how these ties are impacted by document characteristics. Figure 9 provides the relative risk graphs, with point estimates and confidence intervals. There were no significant relative risk statistics involving *inventory management* or *risk/needs assessment*, and there were no significant relative risk statistics that were common across all three performance types.

Innovation Performance. Innovation performance had 22 significant relative risk statistics, encompassing 13/14 practices. With respect to label, after-action reports were more likely than lessons learned reports to tie innovation performance with

communications/IT management or rapid response, and less likely to tie innovation performance with *coordination/collaboration, human resource management, inventory management, knowledge management, local preparation, or leadership/organization structure*. Military organizations were more likely than civilian organizations to tie innovation to *rapid response*, and less likely to tie innovation to *coordination/collaboration, closure, disaster risk reduction, human resource management, local preparation, resource management, strategic planning/policy, transportation/distribution, or leadership/organization structure*. Learning documents in dynamic settings were much more likely to tie innovation to *closure, communications/IT, leadership/organization structure, or rapid response*. Additionally, the sample did not include any ties between *rapid response* and *innovation performance*.

Primary Performance. There were only two relative risk statistics that were significantly different than chance for this performance category. With respect to label, after-action reports were less likely than lessons learned reports to tie innovation performance with *transportation/distribution management*. Civilian organizations were more likely to tie *knowledge management* to primary performance. Setting did not impact ties between practices and primary performance.

Many relative risk confidence intervals included 1 (equal to chance), indicating that report characteristics do not generally impact whether the variables of interest are tied. This effect was most pronounced in primary performance. This indicates that individuals conceptualize these outcomes and linkages to practice about the same, regardless of document characteristics. Surprisingly, setting did not impact these ties, regardless of the changing primary performance objectives in different phases of the

disaster response cycle. This does not hold true for innovation and secondary performance.

Secondary Performance. Twelve relative risk statistics were significantly different than chance, including nine different practices. With respect to label, after-action reports were more likely than lessons learned reports to tie secondary performance with *communications/IT management*. Military organizations were more likely to tie secondary performance to *communications/IT* and *human resource management*, and less likely to tie secondary performance to *knowledge management*, *rapid response*, or *risk/needs assessment*. Learning documents regarding dynamic events were more likely to link secondary performance to *rapid response*, *human resource management*, *leadership/organizational structure* or *closure*, and less likely to link secondary performance with *disaster risk reduction and local preparation*.

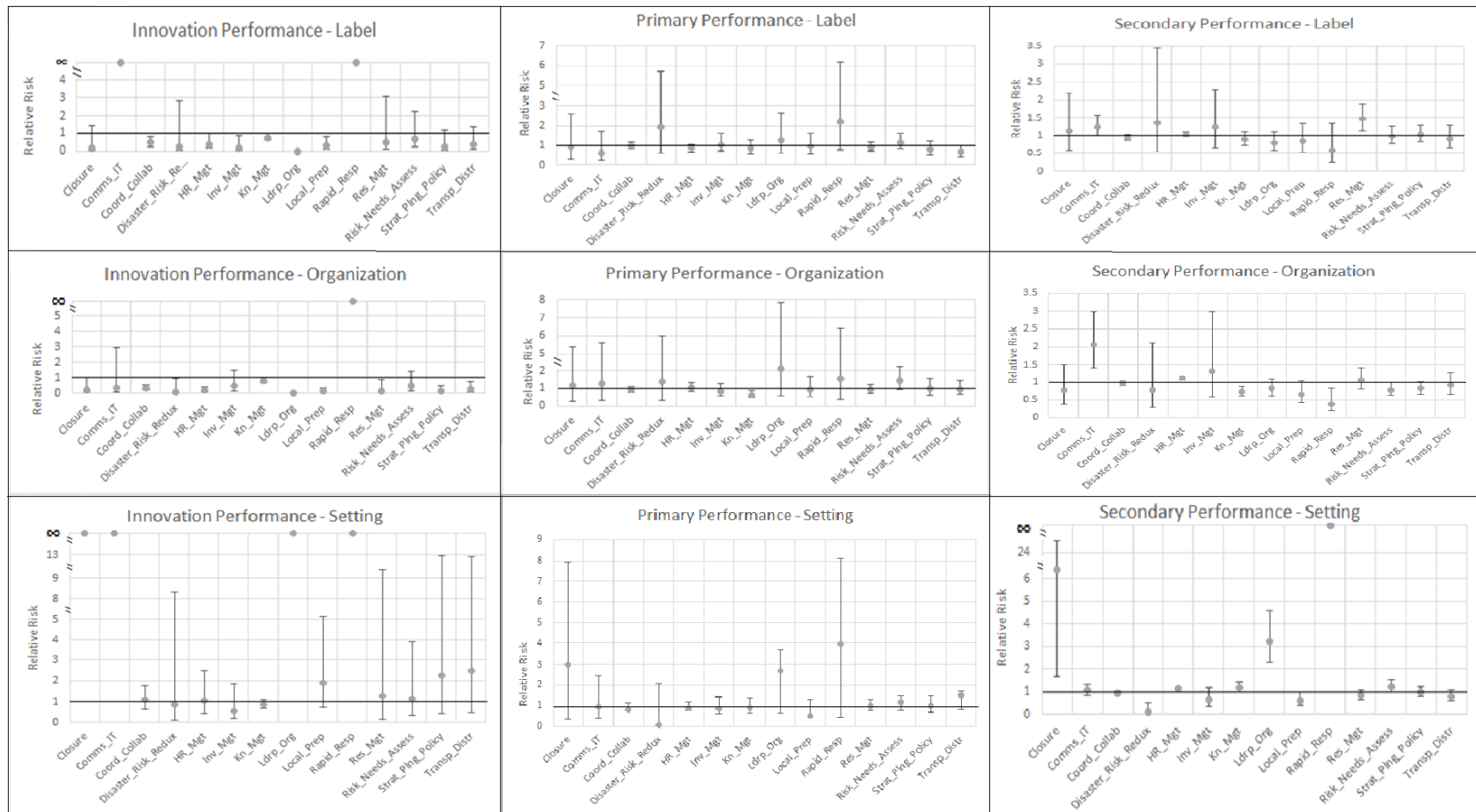


Figure 9. Cumulative Case Study Proportional Analysis Association Results

Knowledge Management and Innovation. Preliminary statistics showed fewer ties to innovation performance than the other categories of performance. Innovation performance, however, had the strongest bivariate tie (in terms of relative frequency), to *knowledge management*, in excess of triple the expected count. As documented in these lessons learned and after action reports, outcomes related to innovation and improvement are most strongly linked to knowledge management practices, including after-action workshops, building positional continuity, and explicit documentation/codification of actions and observations. Nearly all interviews, and all documents, described the reporting process and placed emphasis on this as the default mechanism for knowledge management, learning and innovation. The collection and synthesis of primary observations is a critical step in this process, but can be negatively impacted by a number of factors. These factors include time pressures, both in dynamic and steady humanitarian settings; turnover or training shortfalls; and over-reliance on reporting.

Time. Time pressures pose challenges both in dynamic and steady humanitarian settings. In dynamic settings, practitioners have limited time for reflection and reporting. In one document, evaluation was delayed significantly due to a secondary natural disaster and the shift of resources toward search and rescue efforts (Document 24, military, dynamic, AAR); in another, the report was delayed nearly a year, stating, “(the organization) ought to have carried out AAR periodically during the first six months to take stock and derive lessons and strategic thrust for (the response)” (Document 3, civilian, dynamic, AAR). This negatively impacts the reliability and usefulness of the information provided. Time pressures pose somewhat different challenges for steady-state projects, where project timelines are often short. In one interview, the subject stated

that late reporting of an issue leaves very little time to react “without delays, lack of continuity and loss of momentum” (Interview 6, civilian, varied settings); another stated that late information “can be damning or it can be useless. Sometimes we don’t get information early enough to re-vector... If a project ends and donor funding ends, then we can’t go out to justify an impact evaluation. We can’t get the money for it” (Interview 4, civilian, varied settings).

Turnover and Training. An interview theme was trusting in the reporting process, while also not utilizing it to its full potential. While some subjects were critical, especially with respect to exclusion bias, others expressed blind faith that this process works as intended: “I’ve got to believe it’s in an AAR somewhere” (Interview 5, military, varied settings); reports are “kept, somewhere, not sure where they are. But they’re out there” (Interview 10, civilian, varied settings). One subject described the reporting process as a useful exercise, but one that doesn’t generally propel an organization to innovate:

Lessons learned aren’t necessarily held, examined, prioritized, and then incorporated back into the long-term education and training of the staff. I know it’s not across the board. But it’ll take more than one or two or three events to learn something before it gets put into practice. And a lot of times it’s not until you have a catastrophic failure or some sort of accident which causes you to shut down or stand down. Many of the after action reports are simply not read, and I don’t think that’s any fault of the system itself. (Interview 14, varied background, varied settings)

However, humanitarian skillsets are often perishable, requiring significant recurring use in order to maintain a level of readiness or proficiency. Maintaining proficiency is complicated further by employee turnover, resource scarcity, and regional politics, especially involving military assistance (Interview 5, military, varied settings). Following a response event, one organization created plans and reference materials, including draft information requirements, maps, images, and a country guide describing local plans and organizational structures. These materials were available on a shared portal, but when a similar natural disaster hit the area, “Unfortunately, much of [our staff] were not aware that this information existed and it did not inform their planning” (Document 12, military, dynamic, AAR). Employee turnover frequently leads to loss of organizational knowledge.

Steady state, recurring training is generally seen as an effective solution to this issue; however, this is only a partial solution. With steady state engagements (e.g., training workshops, subject-matter exchanges), organizations may close out the project report without a feedback loop, or other indicator that knowledge was leveraged for change. This is common with third-party trainers, “we don’t have information on what the individuals did with that knowledge once they went back” (Interview 3, civilian, steady), but occurs within organizations and partner networks as well.

Establishing working groups for regular, proactive training and familiarization in steady-state was also mentioned as enabling a faster and more effective activation if required for disaster response (Interview 5, military, varied settings). This approach helps practitioners build familiarity with the process, relationships, checklists and decision making processes while in steady state. Members also accomplish required

training and review reports and lessons learned in support of organizational knowledge, continuity, and the individual's perishable humanitarian skill set. Sometimes these working groups are extended to include key external partners, "to examine the perceptions of key stakeholders... on the successes, best practices and challenges" (Document 4, civilian, dynamic, LLR). This approach was mentioned positively in an interview, as well, stating that "I think the best organizations are part of networks, so that there is some type of continuity and also transmission of lessons and ideas" (Interview 1, civilian, dynamic).

Reliance on Reporting. Over-reliance on reporting as the *de facto* mechanism for organizational learning may be imprudent. The breadth of these reports – as records of events, personal observations, evaluations, positional continuity, and guides for future action – may preclude the documents from being exceedingly beneficial for any one of these purposes. Some documents referenced reporting as a means to consolidate inputs from multiple sources or subordinate branches of an organization, "to facilitate and document several workshops in the affected areas" (Document 4, civilian, dynamic, LLR), or as one input to a larger learning effort "as part of a larger effort, the [organization] is also interviewing key operation participants and collecting information to publish a comprehensive report" (Document 50, military, dynamic, AAR). These may be effective ways to transform these reports as knowledge management tools and leverage them as learning mechanisms.

Additionally, some organizations use external evaluation for retroactive reporting, and some use dedicated, trained after-action teams who then serve as advisors. These dedicated teams examine "all the responses, and look at our task books and staffing

documentation, and use those lessons learned to advise the leadership.... the facilitators will reach out to critical team members... and build a report” (Interview 10, civilian, varied settings). Others mentioned intensive large-scale reviews as appropriate for large operations, “It helped that everyone got together, in the same room, walked through the good and the bad and the changes. We spend three days reflecting on it for the after-action. We wanted it to be action-oriented” (Interview 6, civilian, varied settings). Smaller “hotwashes” are sometimes employed as well to focus on a particular component (Interview 10, civilian, varied settings).

One organization created a lessons learned collection tool. This tool allows for anyone involved in the humanitarian operation to submit confidential observations, which are then vetted and sorted into funding streams. This enables the alignment “in order to direct and enable action for change” (Interview 17, military, dynamic). The individual stated that, while this gets the organization closer to solutions, they are often still limited by time and manpower to enact the recommended changes. To overcome these barriers, the organization focuses efforts toward addressing a few key observations, selected on the basis of frequency and severity.

Publishing Organization and Innovation. Organization type had the highest number of significant practices (10), compared to label (6) and setting (5); of these, there were eight ties to innovation performance – *rapid response, resource management, coordination/collaboration, human resource management, local preparation, leadership/organizational structure, strategic planning/policy, and transportation/distribution*; one tie to primary performance – *knowledge management*; and three ties to secondary performance – *communication/IT, human resource*

management, and *knowledge management*. This indicates a significant difference in how military and civilian organizations perceive innovation performance.

Civilian organizations may have a singularly narrow focus toward a particular demographic or area of interest “that may or may not be heavily triggered by a particular disaster... So, they then have to fit their mission to the disaster and that has varying degrees of success” (Interview 1, civilian, dynamic). This can spark innovation, but perhaps at the detriment of other aspects of performance.

Deterrents to innovation included complacency and risk culture. In one military organization, “there is an assumption, stated by many staff officers, that [the organization] does not need to practice for a mission it executes regularly. Given the turnover of staff and leaders, this assumption is probably not valid” (Document 12, military, dynamic, AAR). In fact, this may be even more critical in military organizations, as the hierarchical structure does not always support innovation; “many military personnel have a fear of failure and experimentation. You have to get over that fear in order to learn and move forward... Saying ‘no’ is easy; finding a way to say ‘yes, let’s try it’ is hard. It’s risky and we are risk adverse” (Interview 17, military, dynamic).

Conversely, civilian organizations may be more accustomed to collaboration and consensus-building as well as relatively flat organizational structures, which provide fewer barriers to innovation. This is supported by proportional analysis results, in which coordination/collaboration practices, though the most frequently cited, were only statistically significant for two relative risk statistics: *innovation-label* and *innovation-organization*. This connection was more likely to be made in lessons learned reports than in after-action reports and in civilian, rather than military, publishing organizations.

Still, civilian organizations encounter issues with coordination and innovation, notably with cross-cultural factors. International collaboration means cultural sensitivities and considerations are critically important. In larger organizations especially, there is a tendency to push a western process and operations style, which is insensitive to local cultures. One example is that “It is assumed that English is the operating language. While it is sometimes a good assumption, it is not helpful at the community level” (Interview 16, varied background, varied settings). Technological innovations may be infeasible, with local practitioners often preferring to use excel products due to accessibility and ease of use.

With partner organizations “another big obstacle is that there’s no standardization, in operations or in the after action reports or requirements,” which makes coordinating logistics support, for example, for water in bottles, cases, aircraft pallet positions, pounds, gallons or liters exceedingly difficult (Interview 16, varied background, varied settings). The lack of standardization clouds the picture of relief provided, and makes identifying shortfalls and areas for improvement challenging.

4.4.3 Recommendations for Practitioners

These results lead us to two main recommendations for practitioners and managers, for the improvement of humanitarian logistics operations and performance:

- (1) **Variation of learning mechanisms.** Trained, dedicated review teams are efficient, but may be too far removed to gain primary insights. Questionnaires may help busy practitioners organize and report observations in near-real time, both for early action and later inclusion in larger review activities. Key positions, to include information managers, should undertake this short assessment at regular intervals, when

combined with other monitoring activities to reduce administrative burden of these tasks. After response activities have ceased, the organization should emphasize action-oriented review, building of organizational knowledge with feedback loops and resultant change.

- (2) **Participation in collaborative learning networks.** Training in steady state supports familiarity with operational partners, procedures, and resources as well as cultural factors that provide a critical foundation for humanitarian success. Such networks proactively support the development of trusting inter-organizational relationships through information sharing, resource pooling, standardization and goal alignment. In retroactive reporting, participating in collaborative networks also supports a wider systems view and increased honesty.

4.5 Discussion

Typically, humanitarian logistics and operations management is complicated by an array of factors, making long-term performance improvement a confounding goal. The thoughtful study of organizational practice provides insights that empower humanitarian practitioners and inform research efforts to the betterment of humanitarian service and the greater body of knowledge. The present study used a cumulative case approach to statistically analyze a collection of 54 learning documents from a ten-year period across the Pacific region in order to examine how practitioners conceptualize practice and performance topics. Expert interviews explored how these topics are presented in learning documents and biases and factors that impact honesty in reporting. The study addressed gaps related to the myopic consideration of technical practices and

operational (*primary*) performance outcomes by including a variety of soft skills and two other categories of performance outcomes, indirect (*secondary*) and *innovation*.

Additionally, while the use of resource-based theory is common, research in the humanitarian domain does not often utilize organizational learning theory. This study leveraged the concept of the individual's *theory in use* to describe a moderating effect between the organization's resource-based capabilities and performance outcomes of interest for long-term success, as described in resource-based theory. This *theory in use* was shown to impact whether practice and performance topics were included, by the type of document (*label* – after-action or lessons learned report), publishing organization (military or civilian), humanitarian setting (dynamic post-disaster or steady state), and most notably by the individual's trust in their organization and organizational partnerships. The learning documents utilized in this cumulative case study are known to present incomplete information; this is due in part to how a lack of trust leads to the deliberate exclusion of critical topics, either through the suppression of information to protect the individual or internalization of the information to protect the organization, especially when that information would reflect negatively.

Relationships between organizational practice and primary performance outcomes (e.g., delivery speed, distribution quantity) were conceptualized in much the same way across all documents and document characteristics, possibly as a result of organizational training and emphasis on well-understood and observable dynamics between technical practices and operational outcomes. Conversely, secondary outcomes were pervasive, highlighting the existing gap between diverse practitioner performance goals and narrow academic focus.

The results provided unique insights into innovation performance, specifically the relationship between innovation and knowledge management practices. With some knowledge management mechanisms (e.g., databases, logs, and positional emails) often being erased or neglected at the conclusion of a humanitarian operation, “learning” is generally relegated to formal reports, with limited effectiveness. While helpful, these reports can be negatively impacted by time pressures, turnover or training shortfalls, and lack of trust. A varied approach to knowledge management can mitigate the weaknesses of any singular practice, especially when learning is both retrospective and proactive, with a process for turning observations into actionable lessons and feedback loops to demonstrate change and learning.

Furthermore, innovation performance was more often associated with coordination/collaboration practices by civilian organizations, for which this is uniquely challenging. Collaborative humanitarian networks aim to bring together diverse organizations with a range of missions, values, and motivations in order to better serve a common goal of humanitarian aid. While such networks present opportunities for information sharing and exchange, these organizations are also in competition for funding, resources, talent and recognition which can impede meaningful collaboration and network-wide learning and improvement.

4.5.1 Theoretical Implications

This study contributes an uncommon blending of resource-based theory and organizational learning theory, which has not to the author’s knowledge been used in the humanitarian research domain. Accordingly, this study adds to the meager humanitarian learning research stream through the use of learning documents and interviews to explore

factors which discourage honesty in reporting. The findings provide insight into how an individual's *theory in use* becomes an organization's *espoused theory*, which can be used to improve organization culture and reduce barriers to learning and improvement. Furthermore, this study supports academic efforts to include soft practices and diverse performance outcomes in humanitarian research.

4.5.2 Managerial Implications

This study provided two main recommendations for practitioners – employing a variety of learning mechanisms and participating in collaborative learning networks – which can improve an organization's learning culture and long-term performance. Additionally, this study provided insight into how trust and bias impact learning, so that these effects can be mitigated at the practitioner level through the building of long-term trusting inter-organizational partnerships.

Results also demonstrated how practitioners lack clarity with respect to how organizational practice impacts other areas of performance, outside of direct operational outcomes. This highlights a training gap that, when corrected, may support efforts for innovation and collaboration toward secondary goals.

4.5.3 Limitations and Future Research

One potential area for future research is examining extensions and variations of the document characteristics, to include report length and time elapsed, and differences between governmental and non-governmental organizations (NGOs). Examination of the sentiment and judgments on the effectiveness of different practices and performance outcomes. Additionally, validating these findings in a variety of settings and with multiple organizations could prove insightful.

Further research could employ goal-setting theory to examine performance, collaboration and balancing objectives. Goals that are specific and challenging are understood to be a critical component to organizational improvement and performance management. Conversely, goal conflicts, such as those caused by multiple stakeholders, competing objectives, or a lack of quantifiable metric, can result in “dysfunctional effects on performance and morale” (Austin and Bobko, 1985). This could provide additional insight into deliberate exclusion and how to mitigate barriers to honesty in reporting.

The learning documents commonly addressed a wide range of non-traditional performance outcomes, including indirect outcomes of interest to external stakeholders (e.g., the assisted state and international humanitarian community). Academic communities should continue to work to fill this research need for practitioners, by addressing a range of performance outcomes beyond direct, operational performance. Those performance outcomes were presented in consistent ways across all documents, as these relationships are easier to observe and teach. More could be done to create a similar understanding of secondary and innovation performance outcomes.

The recommendations – variation of mechanisms and participation in collaborative learning networks – should be tested and examined in greater detail. In Chapter V, a case study explores how the practitioner recommendations – variation of mechanisms and participation in collaborative learning networks – can be leveraged iteratively for innovation and performance improvement over time. The case study also examines use of the lessons learned collection tool referenced by one interview subject (Interview 17, military, dynamic). This tool feeds a formal review process that involves aggregation, real-time review, and consolidation for expert validation and theming, with

connection to funding streams and a feedback loop to offices of primary responsibility.

The study presented in Chapter V explores the relationship between an organization's *espoused theory* and an individual's *theory in use*, the factors that impact a practitioner's decision to submit an observation, what observations they submit, and how these observations are aggregated and used by the organization and network.

V. Performance, Collaboration and Learning in a Humanitarian Field Exercise

5.1 Introduction

From 2009 to 2014, unmet humanitarian demand increased 22 percent (Global Assessment Report, 2015, as cited in John et al, 2019). As disasters become more frequent and more severe, there is a critical need to adapt humanitarian supply chain practices and instill a culture of innovation and learning. This begins with training and investments made in the steady, pre-disaster state (John et al, 2019). The effectiveness of steady state training exercises and games has been largely neglected within humanitarian research streams. As a result, there is a research gap related to how knowledge is built in these training environments, and how that knowledge becomes part of the organizational body of knowledge.

This is part of a larger performance management challenge in this highly variable and uncertain environment. Determining the ideal objective function, requires weighing outcomes of interest across a multitude of stakeholders, the changing needs of the disaster response cycle, and a complicated learning environment – a monumental task that is difficult to address sufficiently. It is only recently, with increased pressure from donors to prove the impacts of their donations, that humanitarian practitioners have become more results-oriented and begun to address some challenges related to metric development and impact measurement (Van Wassenhove, 2006). By some estimates, only 20 percent of humanitarian organization consistently measure their performance (Haavisto and Goentzel, 2015). Those that do, typically focus on operational (primary) performance outcomes of humanitarian logistics processes (e.g., delivery speed and

quantity), as these are convenient measures (Blecken, 2010). However, primary performance outcomes neglect to account for the range of humanitarian priorities of interest to the diverse stakeholder groups, including distribution equity and aid appropriateness; these outcomes are included under secondary performance (Haavisto and Goentzel, 2015). Additionally, learning and innovation performance has been largely neglected within humanitarian research streams, as has the impact of training exercises and games, with most research utilizing simulation research methods (Gralla et al, 2015).

Additionally, performance measurement efforts have been stalled by the lack of usable, reliable data due to technological deficiencies, lagging data analytics, and a singular focus on obtaining immediate results in the field (Pedraza-Martinez and Van Wassenhove, 2016; Van Wassenhove, 2006). This data is difficult to obtain, validate, and standardize, and may be subject to any number of sampling or other biases, which are not easily controlled. The post-disaster fog and urgency diminishes assessment quality, and resources are strained in support of the primary effort. Furthermore, lessons learned from a disaster response may be too specific to that environment, diminishing the potential for knowledge transfer, codification, and application to future responses and other circumstances. Alternately, reporting may be excessively delayed or omitting necessary details, making the data less useful.

These challenges can create goal conflicts, but also opportunities for synergy. Collaboration in steady-state builds and helps maintain required capabilities and relationships, which tend to atrophy in absence of real-world experiences. These engagements encourage information exchange between humanitarian organizations, allowing for the alignment of goals, improved interoperability and network innovation

(Gralla et al, 2015; John et al, 2019). Furthermore, steady state relationship building supports collaborative supply chain strategies through risk awareness, knowledge management, and operational agility (Scholten et al, 2014). These assisting parties may include international, regional and local organizations from government, civilian, and commercial sectors, with diverse skill sets and specializations. Effective operations in this setting require deliberate design and coordination to manage material, information and financial flows (Van Wassenhove, 2006). Furthermore, cultural differences between international and national or local stakeholders, or military and civilian assisting organizations, may also impact the coordination process (Heaslip et al, 2012). More often, however, agencies “often fail to make the effort, or simply find it too difficult to collaborate” or reach consensus (Fenton, 2003). Kunz et al (2017) discussed barriers to communications and data sharing (e.g., trust and competition) as a significant barrier to practically relevant humanitarian research, worthy of further study.

Chapter IV explored how trust and bias impacts the codification of knowledge in organizational learning documents. Individuals observe or take part in organizational logistics operations management practice and draw ties to organizational performance outcomes, but they may fail to disclose this knowledge in formal reporting. This is sometimes unintentional, due to errors in cognition or time effects, but may also be intentional, in order to protect the self or the organization.

Founded in RBT, the present study presents an organization’s resources and capabilities can be leveraged for performance outcomes of interest in order to keep the organization effective and viable long-term. To this effect, there is a growing body of humanitarian supply chain research describing effective HOM practices for disaster

response. However, this does not address specific concerns with long-term system-wide learning and performance improvement. Organizational learning is not often examined within the humanitarian context, and many of the same factors and system dynamics that complicate humanitarian operations also confound learning. The present study leverages OLT to examine how a collaborative learning tool is used in a humanitarian field exercise, moderating the RBT relationship between practice and performance outcomes.

The formal artifacts of an organization, the *espoused theory*, is generally only useful for the transfer of explicit (i.e., procedural) knowledge. The building of tacit knowledge and individual patterns of behavior, *theory in use*, requires first-hand experiential knowledge (Argote, 2013; Argyris and Schön, 1978). The gaps that exist between individual learning as the result of exercise participation and the building of organizational knowledge toward real-world response demand further attention, as insights can improve training effectiveness.

Researchers in this domain have relied heavily on simulation and modeling methods, which limit the utility of findings for practitioner use (Kunz and Reiner, 2012). Conversely, case studies provide more contextualized information, and the study of field exercises, though uncommon, provides a unique platform from which to observe aspects of humanitarian operations in a semi-controlled environment, less impacted by many of the learning challenges endemic to this operating environment. Utilizing operational exercises for research purposes can deliver higher levels of realism than simulations and modeling techniques, while also better contextualizing results for practitioners (Lukosh and Comes, 2019; Laguna et al, 2015).

This paper examines a unique case study of a large-scale, international military field exercise with a humanitarian mission set. The researcher served as a participant observer, embedded in the integrated lessons learned team. The case study leverages field observations along with key personnel interviews, published reports and a database of confidential observations submitted by exercise participants. A balanced approach provides qualitative analysis of themes related to humanitarian operations management, performance and learning as well as quantitative statistical analysis examining the differences between the body of submitted observations and the final report. This gives insight into the editorial process, and the gap that exists between individual and organizational learning.

This case study was selected as a special interest case with unusual attributes (i.e., iterative use of a collaborative learning tool, large scale and multilateral, with military and civilian collaboration) for the purpose of examining the collection tool and process as a critical instance and illustrative case. The exercise involved the United States Air Force (USAF), Royal Australian Air Force (RAAF) and the Japanese Air Self-Defense Force (JASDF) with a host of supporting military organizations and humanitarian representatives. This was the 91st iteration of the exercise and the first to include participants from the international humanitarian community and an integrated humanitarian/combined air force flying exercise scenario. The exercise scenario and published reports remained unclassified, which provided a unique opportunity for research. Furthermore, this was the third iteration of the exercise leveraging a unique collaborative learning tool. This process enabled confidential submission of exercise

observations in near-real time, along with automated summary statistics and trend analysis for incorporation into decision-making processes during the exercise.

The current study tests these recommendations. Exercise observations were collected and compared with formal reports, to examine how practice and performance topics are included and connected. Drawing from the study in Chapter IV, the document label (here, “source”) was found to impact how topics are included and connected, as well as trust relationships. Furthermore, the study seeks to judge how the iterative use of a collaborative learning tool has effectively employed the recommendations from Chapter IV – variation of learning mechanisms and participation in collaborative learning networks – with implications for innovation performance and the building of organizational knowledge. As such, this study tests three research questions:

RQ1: How is practitioner inclusion of practice and performance topics impacted by document type and trust?

RQ2: How is practitioner association of practice and performance topics impacted by document type and trust?

RQ3: How has the iterative use of a collaborative learning mechanism impacted innovation performance?

This study makes numerous academic contributions. First, humanitarian operations management research has generally taken a myopic or incomplete view of performance, generally focusing on the primary operational performance outcomes. This study takes a more holistic stance, utilizing three broad categories of performance – primary, secondary, and innovation – as in Chapters II and IV. Second, the present study also contributes to the understanding of organizational learning, humanitarian operations

management and humanitarian logistics theory. Utilizing raw observations from participants, as well as published reports, the editorial process is scrutinized, providing insight into which observed topics and logistics or operations management practices, are not carried over into reports; how exercise participants perceive organizational practices and performance outcomes; and how this translates to codified learning. This chapter explores the organizational learning theory moderating effect of resource-based theory, introduced in Chapter IV, in more detail. Finally, the research methodology and exercise case study are also underutilized in this research domain, with consequences for practitioner relevance. Coordination between civilian and military organizations in these environments is also a challenging topic, to which the present study contributes insights.

For practitioners, this study tests Chapter IV recommendations – varied learning mechanisms and collaborative learning networks – in order to help practitioners maximize exercise training value. Practitioners can benefit from insights related to how to support the building of organizational knowledge from field exercises and training events, as well as strategies for engaging with other stakeholders within the humanitarian space. This study develops our understanding of humanitarian training effectiveness and applicability to real-world settings.

The rest of this paper consists of Literature Review, Methodology, Results and Analysis, and Discussion.

5.2 Literature Review

This research builds on the theoretical foundation set by the two previous studies in Chapters II and IV, furthering the operationalization of RBT and OLT in the

humanitarian domain. Additional sections on humanitarian collaboration, knowledge management and learning mechanisms, and learning strategies for steady state environments provide insight into the dynamics at play and considerations for organizational performance and learning in the case study.

5.2.1 Theoretical Development

In RBT, an organization's resource base enables performance outcomes of interest for competitive advantage and long-term viability (Penrose, 1959). The resource base may consist of a range of strategic assets and capabilities, to include tacit capabilities such as organizational knowledge, when employed strategically. In acknowledgement of the dynamic nature of operating environments, organizations must work to maintain and improve upon this set of resources to remain effective; this is accomplished via dynamic capabilities, the change and learning capabilities of a firm (Teece et al, 1997; Helfat et al, 2007). In Chapter IV, a set of humanitarian operations management practices were employed as the resource base, and three performance categories were examined as the organizational outcomes of interest.

Additionally, OLT is leveraged, as in Chapter IV, as moderating the relationship between practice and performance outcomes. OLT strengthens this RBT argument by bolstering organizational knowledge and learning capabilities as critical resources of long-term organizational performance.

Under OLT, the process by which information becomes a part of an organization's body of knowledge begins with individual learning. New knowledge must be accepted by an individual, articulated (transferred to others within the community) and codified (integrated into explicit organizational processes), and thereby aggregated to

higher-order groups within the organizational hierarchy (Zollo and Winter, 2002).

Aggregation occurs through an organization's *espoused theory*, or the formal set of rules, policies and procedures which communicate the organization's values and normative standards. This espoused theory differs from individual behavior, *theory in use*, as a result of how individuals internalize and react to these systems (Argyris and Schön, 1978).

Schulz (2008) described how individuals develop *theory in use* depending on a variety of factors. One factor is the manner in which a newcomer integrates into various work communities, which is described as a process of *growing together*, emphasizing that this is not a one-way exchange. Formal, explicit mechanisms (e.g., handbooks and orientation training) aid this process, as do informal, tacit rules expressed through interactions with the new community (Orr, 1996). Another factor is the depth of the newcomer's prior experience; more experience in other contexts make the process of growing together more confrontational, challenging the views and behavior of the established members of the organization. There is a tendency for individuals to adopt the normative values (e.g., ways of acting, convictions and moral values) of the community. These factors all contribute to an individual's background assumptions, termed *theories in use* by Argyris and Schön (1978), which impact an individual's behavior in a community.

While individuals may be largely unaware of their theory in use, the effects can be observed in patterns of behavior and in the development of organizational tools and instruments. This is the *espoused theory*, or the explicit and accessible general knowledge base of a community, generated through conscious analysis of activity

(Argyris and Schön, 1978). Baitsch (1993) observed a similar process, though which a community's *local theory* – the general understanding and values responsible for community cohesion and distinction – leads to *materialization* as communities are formed, organized, and create formal structures for continued development. These formal understandings are then interpreted by individuals in the community, becoming integrated into the background assumptions that unconsciously guide daily work.

Optimally, managers should establish a learning climate and culture that supports individual learning efforts and knowledge sharing. As individual learning aggregates to organizational learning, this process is only as effective as the *theory in use*. Learning outcomes are positively correlated with employees who feel empowered and accepting of formal organizational systems (Argyris and Schön, 1978). Senge (1990) built upon these ideas, popularizing the term, *Learning Organization*, as an organization that facilitates the learning of its members and seeks to continuously transform itself. This orientation is correlated with operational flexibility, firm innovativeness, financial performance, and employee satisfaction (Senge 1990; Calantone et al, 2002).

The process of detecting and correcting errors may take place at various levels depending on the individual's acceptance of these standards. Single-loop learning involves correction informed by normative standards (e.g., consulting the manual); double-loop learning brings the system under scrutiny (e.g., questioning the manual); and deuterio-loop or triple-loop learning addresses how learning occurs within the system (e.g., critiquing how the organization developed the manual) (Argyris and Schön, 1978).

5.2.2 Collaboration

Cultural differences between different organizations, including different conceptualizations of efficiency, time, and deadlines can lead to poor exchanges that make it difficult for trusting inter-organizational relationships to develop (Oloruntoba et al, 2019). With the challenging environment, however, it is not surprising that many organizations seek to build networks and collaborative partnerships. These relationships improve system-wide effectiveness and logistics processes by sharing information and reducing behavioral uncertainty due to cultural differences between international and national or local stakeholders, or military and civilian helping agencies (Heaslip et al, 2012). Some organizations that have established agreements to coordinate for disaster response in the Pacific region include the Association of South East Asian Nations, Pacific Islands Forum, the Secretariat of the Pacific Community, and others. Additionally, the United Nations (and especially UNOCHA), the IFRC, non-governmental organizations, and others are involved in response in the region, as well as government and military actors.

In absence of long-term relationships, organizations must rely on swift trust. Dubey et al (2017) developed a framework for the development of swift trust between temporary teams, and – when conducted in steady state – establishes a foundation for real trust and effective long-term inter-organizational relationships. Antecedents of swift trust include information sharing and reducing behavioral uncertainty. These must be present in order for swift trust to develop in support of commitment and effective coordination outcomes. This assertion is supported by related work by Altay and Pal (2014) and Tatham and Kovacs (2010).

Additional factors, such as status and power, are also at play in these settings. A study by Shaheen and Azadegan (2019) on cooperation and competition in UNOCHA logistics cluster meetings revealed how status (i.e., factors related to respect, motivation, experience, and integration) and power (i.e., resource control) shaped co-opetition dynamics. This had significant impacts on the information shared and the quality of disaster management outcomes. Notably, local humanitarian organizations (low status/low power) had key insights but were intimidated/oppressed by international NGOs (high status/high power). This view was corroborated by Anderson (2019) in her study of post-disaster transitional phases; humanitarian organizations have a tendency to view other humanitarian organizations as competitors. Honest conversations to minimize conflicts of interest, align goals and practices, and gain an understanding of the inbound organization's capabilities. These actions can then be reinforced by intensified training and side-by-side learning in the transitional period between phases.

Relationship Investments. In steady state, relationship investments can take a variety of forms, often influenced by the structure of the organizations (e.g., local, national, or international; NGO or government) and the type of relationship (i.e., communal or exchange-based). The type of organization – military or civilian – and the size can influence coordination behaviors (Heaslip et al, 2012; Kovács and Spens, 2009). The study conducted by Rüscher et al (2019) found that social capital and relationship investments improve response agility (resistance capability). However, in order for mutual trust to develop, all parties need to be satisfied by the types of engagements. Different types of engagements – goal-oriented or social – were preferred by different organizations. These preferences were found to change depending on the disaster

response phase, the organization (e.g., local, national, or international; NGO, government, or military) and the relationship (i.e., communal or exchange-based) (Kovács and Spens, 2009; Heaslip et al, 2012; Rüscher et al, 2019). Rüscher et al (2019) recommended a balanced approach between goal-oriented and social events in diverse collaborative settings.

Pre-established relationships also help to curb the natural inclination toward the suppression of expert knowledge in high-paced response environments, as humanitarian organizations have time to integrate into communities and internalize local customs, priorities, and objectives. Disaster risk reduction projects are smaller in scale, and (relatively) more controlled than disaster relief operations, allowing for humanitarian organizations to observe direct results and impacts, which decreases common errors in organizational learning (Argote 2013).

Military Collaboration for Humanitarian Operations. Collaboration between military and civilian assisting organizations can be especially challenging, as military organizations are inherently non-neutral, in violation of a central tenet of civilian humanitarian operations. As established in the Oslo Accord, military assets are to be leveraged as a last resort for humanitarian response; however, this dynamic is infeasible in maritime Asia due to the “tyranny of distance.” The Asia-Pacific Conference on Military Assistance in Disaster Related Operations (APC-MADRO, 2014) complements the Oslo Guidelines for civil-military coordination in disaster response and amends it for the region. Military forces are often first responders, providing unique airlift, heavy construction, and port management capabilities required for the immediate response

effort. Still, military organizations aim to quickly redeploy once unique support is no longer needed.

As described in the latest Indo-Pacific Strategy Report (IPSR), the United States is committed to regional stability and prosperity through preparedness, partnerships and the promotion of a networked region (Department of Defense, 2019). The IPSR outlines national security interests – protect the American people, promote American prosperity, preserve peace through strength, and advance American influence. Mutually beneficial alliances are crucial, providing “durable, asymmetric strategic advantage” (p. 21). Interoperability efforts aid daily collaboration activities, while building shared understanding and knowledge, closer relationships between militaries and economies. Additionally, the United States Coast Guard has an enduring presence in the region and builds trust through routine and shared maritime safety, security and governance challenges. Similarly, the State Partnership Program, founded in 1993, is one avenue through which National Guard units support various Indo-Pacific nations and the IPSR objectives of protecting the American people, promoting American prosperity, preserving peace through strength, and advancing American influence.

Trilateral partnerships are now being emphasized by the Department of Defense, as part of the national strategy to strengthen key relationships and improve regional peace and security. The United States, Australia and Japan have developed a trilateral partnership, through exercises and training, information sharing and capability building. Japan is similarly committed to supporting a regional balance of power aligned with national interests. Australia and the United States signed a 25-year plus Force Posture Agreement in 2014, providing additional opportunities for bilateral, trilateral and regional

exchange, including capacity building and humanitarian assistance and disaster relief (Department of Defense, 2019).

5.2.3 Knowledge Management and Learning in Steady State

Long-term strategic planning during steady state reduces the direct impact of disasters. Pettit and Beresford's (2009) found information management – defined as strategic and enterprise resource planning, performance and utilization data, and system integration with partners – to be a critical success factor informing crisis decision making. As such, pre-disaster learning and capability building lays the foundation for humanitarian organizations to meaningfully contribute to disaster relief efforts, which can still be undermined by ineffective management or poor coordination (Balcik et al, 2010; John et al, 2019). Before a disaster, there may be more time to undertake deliberate learning and review efforts. However, lack of urgency limits resources and attention.

Knowledge management investments include data collection and analysis, information management, review activities, and continuous learning. Studies conducted by organizations like the CFE-DM and Australia's Asia Pacific Civil-Military Centre of Excellence support practitioner learning and improvement through research, case studies, best practice, local and regional response guides. The practitioners interviewed in Chapter IV referenced a diverse range of learning mechanisms, including workshops, exercises and training; the development or revision of guides, checklists, process or policy; and the adoption of standards. These mechanisms are enhanced by regular or reoccurring collaboration and engagement at a local level.

Larson and Foropon (2018) studied the process improvement approach of a sample of humanitarian NGOs. This study included NGOs involved in development

efforts as well as disaster relief. NGO characteristics that increased the reliance on standards for process improvement included large size, broad scope, managerial centralization, and involvement in projects with more environmental stability (i.e., development vs disaster relief). Notably, NGOs with a strong mission did not tend to have formal quality or process improvement standards. Larson and Foropon propose that organizational culture (often faith-based) may act as a substitute for these standards.

Internal standards have been found to improve employee turnover, aid in meeting donor reporting requirements, and improve service quality (Larson, 2014). International standards such as ISO 9000 and humanitarian-specific codes (e.g., the Sphere Handbook and the Core Humanitarian Standards) may reduce chaos in the field and ensure a level of quality and adherence to humanitarian principles (Tamminga, 2013; Larson, 2014; Jahre and Fabbe-Costes, 2015). It is worth mentioning, however, that mandatory conformance may undermine NGO flexibility, increase donor and government control of NGOs, undermine humanitarian principles, reduce effectiveness, and increase administrative overhead costs (Griekspoor and Sondorp, 2001; Hofmann, 2011; Cosgrave, 2013).

Gaming and exercises are other common approaches, as understanding of the system dynamics shaping humanitarian work is best achieved through dialogue and active, experiential learning. It is accepted that gaming is an effective medium for learning and maintaining proficiency for high impact/low frequency events, such as disaster response (Lukosh and Comes, 2018). Training and conducting exercises during steady state provides excellent opportunities to build capabilities, adaptive skills and relationships for successful outcomes in post-disaster settings. Furthermore, Gralla et al

(2015) made note of a growing need to widen the training audience, which is hindered by the lack of research pertaining to exercise records and evaluation.

While many classroom training courses exist to build the individual's knowledge and humanitarian competencies, large-scale exercises involving numerous organizations are often prohibitively expensive and therefore rare. One example, the World Food Programme's Logistics Response Team training is described in detail in Gralla et al's (2015) study, as a successful example of a large-scale immersive humanitarian training exercise that supports critical skills and competencies, adaptive thinking, the contextual application of known best practices, and teamwork. There is a defined need for more empirical study of the impact of games, especially for learning and dialogue on humanitarian logistics (Harteveld and Suarez, 2015; Lukosh and Comes, 2018). There is little written and disseminated regarding simulated response exercises, "which hinders critical examination of experiences and sharing of best practices" (Gralla et al, 2015: 68).

Conversely, the United States Department of Defense holds over 90 named military exercises in the Pacific region annually with a variety of regional partners and allies. These exercises typically practice warfighting skills; however, there are some that include humanitarian mission sets. While military exercises are not conducted solely to provide humanitarian experience and training, they improve interoperability with regional partners and allies and promote the sharing of information and the development of long-term trusting relationships which is crucial for response settings. Exercise COPE NORTH is one such United States-led trilateral exercise, conducted with Japan and Australia, with a primary goal of improving interoperability. The exercise is hosted annually in Guam, the westernmost United States territory and key strategic hub. "Field"

conditions are established in Commonwealth of the Northern Mariana Islands (CNMI), a training location, utilized for air, surface, and subsurface training activities for the joint force and multilateral exercises.

5.2.4 *Learning Strategies*

A commitment to organizational learning, specifically capturing, codifying, and transferring logistics knowledge, plays a role in sustaining performance and improving learning processes between response events (Van Wassenhove, 2006). In Ford and Schmidt's (2000) study of pre-disaster training, the authors addressed three main problems with emergency response learning in training environments – retention, generalization and teamwork – and provided strategies for mitigating these barriers.

These strategies are interconnected, and employing multiple strategies may have synergistic effects. With regards to retention, these are often perishable skill sets, requiring significant recurring use in order to maintain a level of readiness or proficiency. Retention can be improved through training that fosters a mastery orientation (i.e., a growth mindset, and not a performance or evaluation mindset), allows learners control over the environment or learning process, and promotes active and engaged learning. Additionally, lessons from one event may not generalize well to other environments or circumstances, as such steady-state training should foster adaptive learning and collaboration skills. This can be bolstered through guided discovery learning (in which learners are presented with partial information), error-based learning (through making or identifying errors) and meta-cognition (i.e., self-evaluation, monitoring and performance assessment). Teamwork may be enhanced by focusing underlying mechanisms of *team* –

rather than *task-work*, by developing shared mental models (e.g., through cross-training and exposure initiatives), and by deliberate team leadership training.

The individual's learning goals have a significant impact on their individual learning outcomes (Dweck, 1986). Individuals with a *mastery* orientation believe they can develop new skills over time through continued effort, while those with a *performance* orientation are focused on achieving higher performance, even in training environments, and are less open to criticism and feedback. Mastery orientation motivates experimentation, earnest effort and more complex learning strategies in training environments (Ames and Archer, 1992; Fisher and Ford, 1998). Providing adult learners more control over the pace, method and environment of their learning supports active engagement and a mastery orientation. It also supports *meta-cognition*, the self-regulation of planning, monitoring and evaluating one's own learning (Butterfield, 1989). This allows for a deeper understanding of concepts and their interrelationships, enabling better transfer to different and more complex tasks. When coupled with mechanisms that support a mastery mindset, such as learner control and the use of error-based learning mechanisms, trainees better learn how to “cope with and learn from error situations that otherwise might have negative motivational effects” (Ford and Schmidt, 2000: 206).

This may be especially pertinent for risk-adverse military audiences.

Additionally, in the collaborative learning environment, teamwork skills are crucial; these, however, are difficult to teach explicitly. Team members must understand interdependencies and the consequences of their actions in order to effectively function, both as a team and with respect to an individual's own tasks. This requires compatible mental models, which can be developed through cross-training and active learning styles.

Additionally, adaptive expertise supports teambuilding skills indirectly. Adaptive expertise is most effectively applied for learning and improvement when the effort is collaborative, “generating creative solutions to problems through the efforts of many” (Ford and Schmidt, 2000: 199). Discovery and error-based learning reinforce adaptive expertise by encouraging experimentation with a greater range of strategies. Adaptive expertise is especially important in HOM settings.

Team leaders should adopt a mastery orientation, facilitating team development and learning beyond the initial team forming stage (Senge, 1990). Pre-briefs are useful tools to discuss team goals, strategies, roles, responsibilities, and to anticipate and plan for likely problems. In one study, “the extent to which they utilized low-workload (steady state) periods to discuss how they would handle emergency situations” was a distinguishing factor between high- and low-performing groups (Orasanu, 1990 as stated in Ford and Schmidt, 2000: 211). Additionally, after-action review can be an effective tool, when leaders foster a climate of openness (e.g., by starting with their own self-critique), and when the discussion is centered on diagnostic, process feedback instead of outcome feedback. This is more useful and keeps the conversation focused on productive action (Ford and Schmidt, 2000).

The body of literature supports early and regular collaboration to build partner trust. In steady state, this is best accomplished by diverse learning mechanisms and learning strategies that emphasize growth and mastery, meta-cognition, and team building. These strategies allow for individuals to grow together in their *theory in use*, with benefits for *materialization* and codification of insights into the organizational knowledge base.

5.3 Methodology

We utilize a case study approach with participant observation, interviews, and statistical document analysis. The statistical analysis has two components: (1) testing of log-linear models to determine patterns of inclusion, and (2) proportional analysis using the relative risk of specific practice/performance ties. Figure 10, the process flow diagram, outlines the research design.

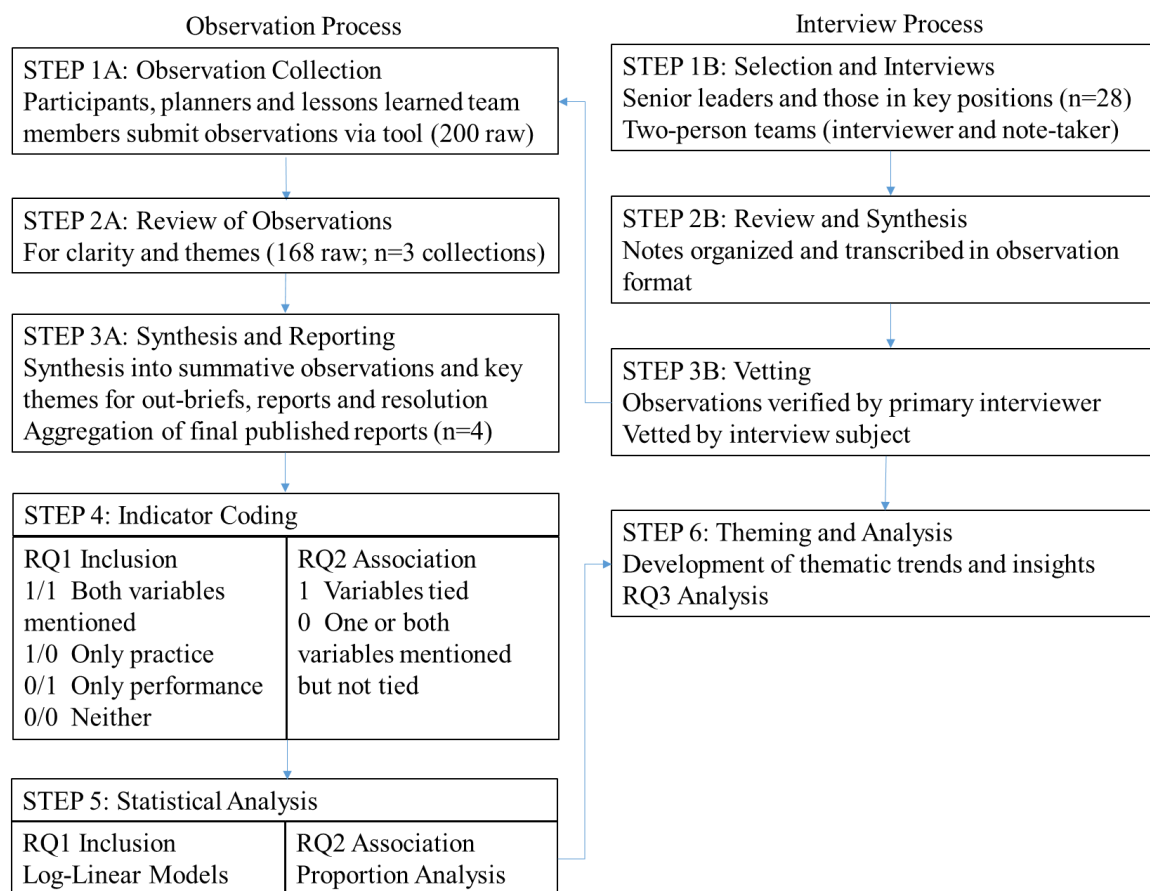


Figure 10. Case Study Process Flow Diagram

This research is focused on the Pacific region, due to the frequency of humanitarian operations and the numerous concerted efforts that the Pacific humanitarian

community and United States Department of Defense is currently undertaking to improve readiness and resilience. The United States military routinely exercises with numerous partners in the Pacific. This study leverages insights from one such field training exercise, exercise COPE NORTH 2020, conducted annually on a trilateral basis with the USAF, RAAF, and JASDF, as well as a small footprint of civilian practitioners from the United Nations World Food Program, Australian Department of Foreign Affairs and Trade, and the United States Department of Defense CFE-DM. This 18-day exercise featured a Humanitarian Aid/Disaster Relief exercise scenario which then escalated into a Combat Air Forces Large Force Employment flying exercise. The exercise was primarily focused on trilateral interoperability, building relationships and common understanding, as well as developing military capabilities useful for humanitarian response. The civilian component was small, but a critical first step toward a “whole of government” approach to military humanitarian training, more typical of a real-world response scenario.

This case study was selected as a special interest case with unusual attributes (i.e., iterative use of a collaborative learning tool, large scale and multilateral, with military and civilian collaboration) for the purpose of examining the collection tool and process as a critical instance and illustrative case. The exercise took place in February 2020 with main operating hub at Andersen Air Force Base, Guam, and deployed spokes in the CNMI. This was the 91st iteration of the exercise, which involved 104 aircraft from 24 flying units and over 2600 personnel; however, this was the first to include participants from the international humanitarian community and an integrated humanitarian/combined air force flying exercise scenario. The exercise scenario and published reports remained unclassified, which provided a unique opportunity for research.

5.3.1 Analysis Method

Case study research is the deep, focused study of a single unit, to attain a unique view of a research problem and thereby gain a better understanding the general class. Research questions may encompass describing, understanding and explaining a problem or situation (Gerring, 2004; Baxter and Jack, 2008). This methodology is also popular with practitioners, as a tool for organizational learning and evaluation of a new program or process (Baskarada, 2014). In the present study, case study methods are used to serve both these academic and practitioner purposes.

The case examined in the present study was selected on the basis of purpose as well as convenience. The field exercise represented a special interest case, chosen for its unusual attributes (i.e., collaborative learning tool, large scale and multilateral, with military and civilian collaboration). As such, this case study is both a critical instance case which “examines a single instance of unique interest or serves as a critical test of an assertion about a program, problem, or strategy” and an illustrative case, “descriptive in character and intended to add realism and in-depth examples” (GAO, 1990).

The case was presented as an opportunity to act as a participant observer, following an exploratory interview conducted for the cumulative case study presented in Chapter IV, and so was also partially selected on the basis of convenience. In this capacity, I served as a member of the Lessons Learned team, which consisted of USAF, RAAF and JASDF personnel. All members of the team had some form of lessons learned, exercise evaluation, and/or research and analytics experience. In execution of my duties as a member of the team, I had full access to all exercise training, briefings,

personnel, and locations, and was able to observe operations throughout the main hub as well as on the island of Rota, where expeditionary medical capabilities were exercising.

Varying triangulation techniques were used, in order to overcome weakness or bias from reliance on any single investigator or method. Denzin (2006) identified four basic types of triangulation: data, investigator, theory and methodological. The present study employs multiple forms. Multiple data sources and research methods are used, with statistical analysis of raw observations and published reports from a range of participants, field observations and key personnel interviews. The participant observer's lessons learned team consisted of five people, with varying backgrounds, allowing for investigator triangulation and more diverse and comprehensive field notes and observations. Similarly, interviews were conducted in two-person teams, with a primary interviewer and a recorder, and interview observations were reviewed by both members and the team lead before validating with the interview subject. A second researcher qualitatively coded a sample for the statistical document review, achieving an inter-rater reliability rating of 90 percent.

Participant Observation. As a research method, participant observation is frequently used in studies of cultural or social groups, including organizations and small group settings. The strengths of this method include the ability to cover events in real time with contextual details and insight into interpersonal behaviors and motives. Observational evidence can provide additional information with regards to how formal mechanisms are employed and the problems encountered in execution (Yin, 2009). Conversely, participant observation may provide only a narrow perspective or there may be concerns with reflexivity or participant observer influence (Yin, 2009).

The primary researcher is a member of the United States Air Force and was embedded in the exercise, as part of the 5-person trilateral Combined Exercise Control Group Lessons Learned Team. As part of these duties, the researcher contributed to the Lessons Learned team effort, assisting exercise participants with the observation collection tool, providing firsthand exercise observations, interviewing key personnel and preparing/briefing the daily morning operations meeting as well as the final out-brief. The researcher's previous experiences enabled her to be effective as a participant observer in this setting. As an active duty member of the United States Air Force and a logistician with emergency response and contingency planning experience, she had unique insight to military aspects of the exercise. With previous research and interview experience, she was permitted to select and lead the majority of interviews, and focus efforts primarily on the humanitarian portion of the exercise. Additionally, as an international relations student with foreign language skills and regional travel experience, she was able to quickly build relationships with Japanese participants, to better understand their unique challenges and perspectives in this context. Her previous humanitarian research and international experiences throughout the region of interest also permitted meaningful exchange with civilian participants, two of whom she had met and worked with on other occasions and notably for the study in Chapter IV.

Langley and Klag (2019) asserted that, though challenging, balancing perceptions and challenges, access, and participation while upholding professional distance is attainable. Access and insider perspectives allow for a more accurate picture of case study phenomenon but may be subject to more potential biases. To establish trust and gain access, an investigator may need a sympathetic background, generally contrary to

good social science practice. Additionally, participant role may demand more attention or time, limiting or conflicting with opportunities as an observer (Yin, 2009). These trade-offs were mitigated by de-briefs and de-confliction with other members of the team and seamless integration into the established organizational structure; in these military exercise settings, the presence of “white cell” non-player observers and evaluators is common; the presence of the primary researcher did not alter normal exercise operations or depart from typical team composition and was therefore minimally intrusive. Additionally, with a five-person team, members were able to physically disperse in order to observe different simultaneous events and expand the scope of observations, thereby reducing bias; notably, two two-person teams forward deployed to observe operations and conduct interviews on two different Pacific island “spokes.”

Active participation was limited and field observations were casual in nature, largely emerging from team conversation and reflection after the day’s observation activities. The lessons learned team attended many meetings, briefings, trainings, and de-briefs; involvement in these settings was limited to advertising the lessons learned collection tool. Interviews were conducted after the main operations, to be retrospective in nature and not impact the course of events. The lessons learned team briefed the latest thematic trends and summary statistics as part of the morning operations meeting to the exercise control group, and otherwise was available for participants to discuss observations and issues. When games are used for research, players should be engaged for meta-cognition (i.e., self-monitoring of learning) and introspection (Lukosh and Comes, 2018). Outside of focused interviews, periodic lesson learned tool reminders

provided in stand-ups, briefings, and opportune conversations served to trigger individual participants.

Interviews. Interview methods can be useful when insight is needed into an individual's opinions and motives involved in a complex social event (Rubin and Rubin, 2012). Interviews can be targeted and provide insight into perceptions and causality, but may also be biased due to reflexivity, recall, or lack of trust (Yin, 2009). For these reasons, interviews were not recorded, and a second team member served as recorder/note-taker.

Semi-structured interview methods, following a set of questions, but allowing for deviations, as appropriate. This interview methodology is more conversational, loosely following a set of questions or key topics. Interviews questions used in this study were related to challenges, successes, shortfalls, interoperability, training realism and effectiveness (see Appendix C-1 for case study interview guide). As such, these interviews served to enrich our understanding of the experiences of exercise participants, planners and facilitators.

Over the course of the exercise, 29 semi-structured interviews were conducted with key personnel. All interviews were conducted under the auspices of the trilateral lessons learned team. Interviews were conducted in-person, in the subject's native language as-required, with a primary interviewer and a secondary interviewer/note-taker. Interviews were not recorded; however, thorough notes were used to promptly generate observations in the lessons learned collection tool format, which were then validated by the primary interviewer and the interviewee. These observations were then integrated into the collection tool.

Statistical Document Analysis. The use of documents for research provides a stable, unobtrusive, and exact data source that can provide broad coverage on a case study topic. However, documents can be difficult to find or access and subject to selection and reporting bias (Yin, 2009). The documents utilized in this study were produced during the case study exercise. Participation in the exercise provided access and field observation provided insights to validate details, mitigating some concerns. Additionally, the researcher solicited additional inputs in order to mitigate selection and reporting bias. The documents are grouped into two categories, or *document labels*: raw *observations* (organized into collections, by source) and formal *reports* (published on the APAN site).

Learning documents were qualitatively coded using the NVivo software package. Sections of text were tagged with codes, as applicable, for the eleven humanitarian operations management practices and three categories of performance outcomes of interest (see Table 13). To avoid bias due to repetition, these qualitative codes were then adapted into indicator coding schemes for statistical analysis and testing of the two research questions. This structured the data into a set of discrete (i.e., countable) independent and dependent variables, with nominal levels (i.e., no ordering effect). The research questions were:

RQ1: *How is practitioner inclusion of practice and performance topics impacted by document type and trust?*

RQ2: *How is practitioner association of practice and performance topics impacted by document type and trust?*

Categorical data behaves differently from continuous data and therefore requires different analytical tools (Schubert Kabban, 2019a). The primary tool for this form of analysis is the contingency table, traditionally 2x2, which provides probabilities and conditional, joint and marginal distributions of the variables of interest. This study tests probabilities in terms of a third, layering variable – *document label*. These tables allow for the testing of independence and association relationships between row and column variables (i.e., log-linear modeling, as utilized for the first research question), and the comparison of event probabilities, using relative risk, odds ratios, or difference in proportions, as utilized for the second research question (Schubert Kabban, 2019a; Schubert Kabban, 2019b).

These methods are commonly utilized in medical and social science research, but they are uncommon in logistics and supply chain studies. This presents a unique perspective for analysis and new insights into the relationships between these variables, on the basis of *document label*. Methodological details are described in Chapter IV.

Finally, pattern matching techniques were used to compare collection tool statistics and document statistics with field observations and interview insights to address the third research question:

RQ3: How has the iterative use of a collaborative learning mechanism impacted innovation performance?

The analytical process for this case study follows a pattern matching technique similar to the one described in Chapter IV and bolstered with participant observation. Pattern matching is “one of the most desirable techniques” for this form of research, comparing

predicted patterns with empirical observations, in order to identify gaps and differences (GAO, 1990). Large gaps are of special interest, as are counterintuitive results or predictions (Campbell, 1975).

5.3.2 Data Collection

For this study, data was collected through participant observation, field notes, and interviews, as well as utilizing a lessons learned collection tool. The tool was developed by the participating team lead, from the United States Air Force Pacific Air Forces Lessons Learned (PACAF/A9L). The tool was designed to facilitate the collection of observations and provide some preliminary analysis. It is hosted on multiple network enclaves depending on classification requirements (note: all data was unclassified for this exercise), utilizing the Microsoft software suite. All personnel involved in the exercise or its planning/facilitation were required to establish APAN accounts, providing access to the tool and confidential submission of observations. The lessons learned collection tool user interface is provided for reference in Appendix C-2.

As personnel submitted exercise observations, lessons learned team members were able to view and analyze the findings. Findings could be organized by primary and secondary themes (including doctrine, organization, training, materiel, interoperability, leadership and education, personnel, facilities, policy, battle rhythm, command and control, and knowledge management) for trend analysis. After an observation was submitted into the tool, a member of the lessons learned team reviewed it for clarity and completion. Interview observations were reviewed by the primary and secondary interviewer and vetted by the interview subject. These observations were then presented to senior leadership daily in the morning operations meeting, providing insight into the

issues personnel were facing at that point of the exercise in near-real-time, with summaries as part of the out-briefs.

The main goals of this tool are to support the efficient collection of high-quality observations from a diverse audience, to enable early vetting and preliminary analysis in near-real-time, and to expeditiously provide quantitative data to inform decision-making and streamline the resolution process. Products from the tool can be easily exported into reports and slides for presentation as well as aggregation at higher levels, providing a structure and process for resolution (PACAF/A9L, 2019).

5.3.3 *Sample Characteristics*

The sample includes a total of 719 qualitative codes, across all practice and performance variables and seven learning documents. A total of 200 exercise observations were collected. Of these, 33 were removed because they were unrelated to the humanitarian portion of the exercise, e.g., combat air force-specific observations and observations related to exceedingly trite component-specific issues. Of those documents, four are after-action reports submitted by the exercise lead and by USAF and RAAF components. The remaining documents are collections of observations (167 total) from three unique sources: exercise participants (88 observations), exercise control team members (60), and observations by lessons learned team members (19). All participating nations and civilian organizations provided observations to the tool and were represented in interviews. Notably, there was no civilian humanitarian participation from Japan. Table 12 provides summary details for documents and interviews.

Table 12. Case Study Sample Summary

Learning Documents		Total n (%)	Interviews		Total n (%)
<i>Observations</i>		167	<i>United States</i>		13
	Participants	88 (52.7%)		Military	11 (39.3%)
	Control Team	60 (35.9%)		Civilian	1 (3.6%)
	Lessons Learned Team	19 (11.4%)	<i>Australia</i>		7
<i>Reports</i>		4		Military	5 (17.9%)
	Post Activity Report	Australia		Civilian	2 (7.1%)
	Lessons/Obs. Report	United States	<i>Japan</i>		8
	Final Report	Trilateral		Military	8 (28.6%)
	Supplemental AARs	Trilateral	<i>International</i>		1
				Civilian	1 (3.6%)

5.3.4 Variables

Eleven common humanitarian operations management practices are utilized to examine how knowledge is aggregated from observations into reports; these practices span core logistics tasks (e.g., inventory management, distribution and transportation), “soft” practices involving internal management practices (e.g., human resource management, leadership and organizational structure) and collaborative practices, such as integration or interoperability with partners. These practices are a subset of the variables utilized in Chapter IV. Local preparation, disaster risk reduction, and closure were excluded, as these practices had limited play in this exercise construct. Table 13 defines these variables and provides some summary statistics.

Table 13. Case Study Variables and Summary Statistics

Performance		Docs	Codes
Innovation	Outcomes related to demonstrations of organizational learning, change and growth; experimentation and policy development	7 (100%)	22 (3.1%)
Primary	Outcomes related to primary humanitarian mission fulfilment; providing the right supplies/services to the affected population, at the right place, at the right time, and in the right quantities; logistical/operational effectiveness	7 (100%)	76 (10.6%)
Secondary	Other outcomes related to stakeholder priorities and requirements, including those from assisting agencies/nations (e.g., donors, humanitarian community) or assisted agencies/nations (e.g., the host nation communities, planners and leadership; aid beneficiaries)	7 (100%)	142 (19.7%)
Practice			
Communications and Information Technology	Practices related to the establishment, sourcing and use of communications systems, equipment, networks and platforms; includes radios, phones, mobile apps, data services, APAN, email and other classified or unclassified collaborative tools	7 (100%)	31 (4.3%)
Coordination and Collaboration	General practices related to established and solidifying productive relationships with various assisted/assisting organizations; includes efforts that contribute to cultural understanding, goal alignment, resource pooling, integration, and standardization	7 (100%)	90 (12.5%)
Human Resource Management	Practices related to establishing and employing an effective staff; to include practices related to technical training, local expertise and inter/cross-cultural understanding, beddown, position manning and team composition	7 (100%)	86 (12.0%)
Inventory Management	Practices related to sourcing and management of aid inventory, including donated goods, and suitability for use	2 (28.6%)	3 (0.4%)
Knowledge Management	Practices related to the handling, accessibility and flow of information, including tracking, accounting and reporting actions	6 (85.7%)	72 (10.0%)
Leadership and Org. Structure	Employment and understanding of key relationships, chain of command, and organizational structure	6 (85.7%)	40 (5.6%)
Rapid Response	Expedient use of rapidly deployable resources (to include equipment, inventory, financial resources, and human resources), especially in pre-formed kits	4 (57.1%)	7 (1.0%)
Resource Management	Practices related to sourcing and employment of organic resources and capabilities, including equipment and funding; excludes transportation assets (see "transportation and distribution"), communications assets (see "comms and IT"), and personnel (see "HR management")	7 (100%)	44 (6.1%)
Risk and Needs Assessment	Practices related to the gathering of risk and needs information (e.g., through site surveys or use of intelligence assets) and the development of priority information requirements	6 (85.7%)	37 (5.1%)
Strategic Planning and Policy	The establishment and employment of clear organizational goals and performance criteria, areas of operation, rules of operation in the local environment, and supporting doctrine and policy	7 (100%)	61 (8.5%)
Transportation and Distribution	The sourcing and use of transportation assets suitable to the local environment; the establishment of port operations, distribution networks and distribution rules regarding the prioritization of aid and beneficiaries	5 (71.4%)	8 (1.1%)

5.4 Analysis and Results

The present study examined three research questions regarding how practitioners perceive and report exercise practice and performance outcomes:

RQ1: *How is practitioner inclusion of practice and performance topics impacted by document type and trust?*

RQ2: *How is practitioner association of practice and performance topics impacted by document type and trust?*

RQ3: *How has the iterative use of a collaborative learning mechanism impacted innovation performance?*

Patterns of inclusion and association varied between submitted observations and final reports, due in part to cultural factors and ambiguity. Findings also demonstrated progress made from the iterative use of a collaborative learning tool and the benefit of multiple learning mechanisms and partnerships.

5.4.1 Practitioner Inclusion of Practice and Performance Topics

This research question seeks to determine which practice and performance outcomes were discussed in the learning documents, and if this was significantly different between raw observations and published reports. This provides insight into the editorial process, and which observed topics are not carried over into reports.

Of the 33 bivariate pairs, there were 27 statistically significant associations. All were significant for Model 0, complete independence (p-value < 0.05). Five more bivariate pairs did not perform better than chance for any of the tested models, which indicates that the complete independence model is the best fit for these associations as well. Additionally, there was one association, *risk/needs assessment-innovation*, for

which Model 4 was a better fit, conditional independence given the performance type. This association was not significant at any p-value, but performed better than chance. Inclusion results are displayed in Table 14.

Uniqueness of innovation performance. All practice associations with primary and secondary performance were statistically significant for complete independence; only practice-innovation performance pairs deviated from this pattern. This consists of five associations that defaulted to the complete independence model – *communications/IT*, *leadership/organizational structure*, *resource management*, *strategic planning and policy*, *transportation/distribution* – and one association for which the conditional independence model was the best fit, *risk/needs assessment-innovation*.

While none of these associations were statistically significant, this still serves to demonstrate that patterns of inclusion for innovation performance differ between raw observations and finalized reports. This may be partially a function of sample size; there were only 22 codes for innovation performance across all documents. This makes up 9.2% of performance codes (3.1% of total codes), compared to 31.7% primary performance (10.6% of total) and 59.2% secondary performance (19.7% of total).

Table 14. Case Study Log-Linear Model Inclusion Results

<i>Document Label</i>	<i>Innovation</i>	<i>Primary</i>	<i>Secondary</i>
<i>Communications/IT Mgt.</i>	Independent	Independent*	Independent*
<i>Coordination/Collaboration</i>	Independent*	Independent*	Independent*
<i>Human Resource Mgt.</i>	Independent*	Independent*	Independent*
<i>Inventory Mgt.</i>	Independent*	Independent*	Independent*
<i>Knowledge Mgt.</i>	Independent*	Independent*	Independent*
<i>Leadership/Organization Structure</i>	Independent	Independent*	Independent*
<i>Rapid Response</i>	Independent*	Independent*	Independent*
<i>Resource Mgt.</i>	Independent	Independent*	Independent*
<i>Risk/Needs Assessment</i>	Cond. (Perf.)	Independent*	Independent*
<i>Strategic Planning/Policy</i>	Independent	Independent*	Independent*
<i>Transportation/Distribution</i>	Independent	Independent*	Independent*

P-value significance: '****' 0.001 '***' 0.01 '**' 0.05

Differing coverage of topics. Reports serve to aggregate and consolidate raw observations. This effect was demonstrated by examination of the summative observations, extracted by the lessons learned team in conjunction with a team of subject-matter experts. These summative observations distilled raw observations into key findings, along various themes, with a suggested office of primary responsibility, recommendations, and funding stream.

Raw observations had high counts for the following associations: *coordination/collaboration-primary* and *secondary*, *human resource management-secondary*, *knowledge management-secondary*, *resource management-secondary*, *risk/needs assessment-secondary*, *leadership/organizational structure-primary*; these correlate with the summative observations, regarding exercise planning and preparation (52 observations), scenario realism and civilian agency involvement (25), roles and responsibilities (20), training objectives (12), command and control structure (33),

aeromedical evacuation integration (12), communication networks and APAN (13), and host base infrastructure and support (11).

Exclusion due to cultural factors. Field observations indicated that cultural factors, including language (e.g., military jargon and English proficiency) and organizational culture (e.g., risk tolerance and learning orientation), played a role in the exclusion of practice and performance topics. Community-specific jargon can exclude non-members; this effect was observed and amplified with three military services from different nations, a multitude of career fields, and civilian participants as well. This can be a barrier to participation in exercise operations and in retrospective or reporting activities as well.

Language barriers further hindered participation by Japanese service members. Limited translation support was available for exercise meetings and upon request. A translation of the collection tool was made available for reference; however, the form was not kanji-enabled, which required submission in English and may have been a barrier to submission. Furthermore, members described that they were hesitant to critique exercise operations – as they were effectively guests of the United States Air Force – as well as decisions made by senior leaders – as this could be perceived as disrespect to superiors.

Additionally, field observations regarding learning culture showed significant differences between national communities. The United States Air Force has more personnel than the other nation's Air Forces, which sometimes allows for distinct lessons learned teams and evaluation teams. When these functions are distinct, as they were for this exercise, the lessons learned team members can emphasize a mastery orientation, rather than one of performance, which encourages greater honesty and insights related to

causality and problem-solving. Conversely, the Royal Australian Air Force has lower manning and therefore requires their lessons learned personnel to serve in both capacities. This dual-role splits the individual's efforts and attention and also changes the interview dynamic toward a performance orientation. In keeping with this logic, interviews were not recorded; this mitigated some concerns regarding reflexivity and bias.

5.4.2 Practitioner Association of Practice and Performance Topics

Proportional analysis of the relative risk provided insight into how practice variables are tied to performance variables, and allow us to compare how this transfers from raw observations to published reports. Figure 11 provides the relative risk graphs, with point estimates and confidence intervals.

Similarity of primary and secondary performance associations. Ties to primary and secondary performance followed a similar pattern. These ties were less likely to be made in reports than in observations. This finding indicates that reports have a narrower focus than the raw observations, which may include insights from individuals with more diverse outcomes of interest. Some ties were only included in the observations, resulting in a relative risk statistic of zero – *inventory management-primary*, *leadership/organizational structure-primary*, *rapid response-primary*, and *inventory management-secondary*. These are sampling zeros, which could be influenced by the small document sample size for this case study.

Reports emphasized ties to innovation performance. One tie was only mentioned in observations – *risk/needs assessment* – and three were only mentioned in reports – *inventory management*, *rapid response*, and *transportation/distribution*. The remaining relative risk statistics for ties to innovation performance were inconclusive

(i.e., confidence intervals overlapping with chance) – *communications/IT, coordination/collaboration, human resource management, knowledge management, leadership/organizational structure, resource management, and strategic planning and policy*. This indicates that the reports represent many of the same concepts and ties as observations, with aggregation from other sources contributing a few additional ties. While anecdotal evidence suggests that reports have limited value, these results demonstrate some combinatorial power evident in the published reports.

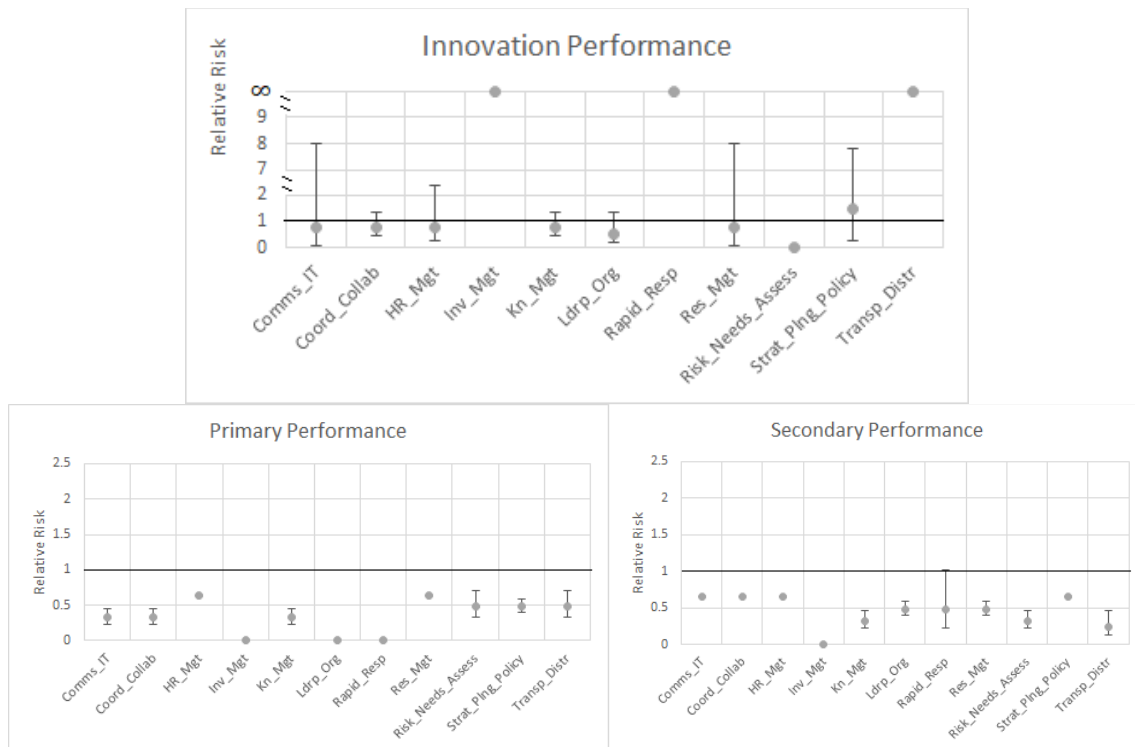


Figure 11. Case Study Proportional Analysis Association Results

Lack of ties due to role ambiguity. Participants may have excluded some practice-performance ties due to lack of clarity, specifically with respect to the organizational structure, lines of responsibility, and expectations. When some units were forced to pull out from the exercise due to real world requirements (e.g., Australian

bushfire support), other personnel and units were tasked to fulfill their assigned duties. This shift contributed to the dual-tasking of some participants as both training audience and exercise control. Without a clear delineation between training and control, lines of effort and expectations became muddled, impacting coordination and operational effectiveness. Furthermore, this made causal relationships between practice and performance more difficult to observe, resulting in fewer related observations and ties (Interview 3, military, American; Interview 1, military, Australian). Interview subjects recommended leveraging exercise planning conferences to a greater extent in order to conduct interoperability cross-training, to clarify lines of effort, and align scenario programming with training and education goals (Interview 1, military, Australian; Interview 2, civilian, Australian).

5.4.3 Collaborative Learning Tool

The lessons learned collection tool was effectively leveraged to collect observations from the diverse participants. Figure 12 displays the collection tool results, with 200 observations sorted by primary and secondary themes (PACAF/A9L, 2020). The two most prominent themes were training and policy, which were submitted as a primary or secondary theme in 36 and 33.5 percent of observations, respectively.

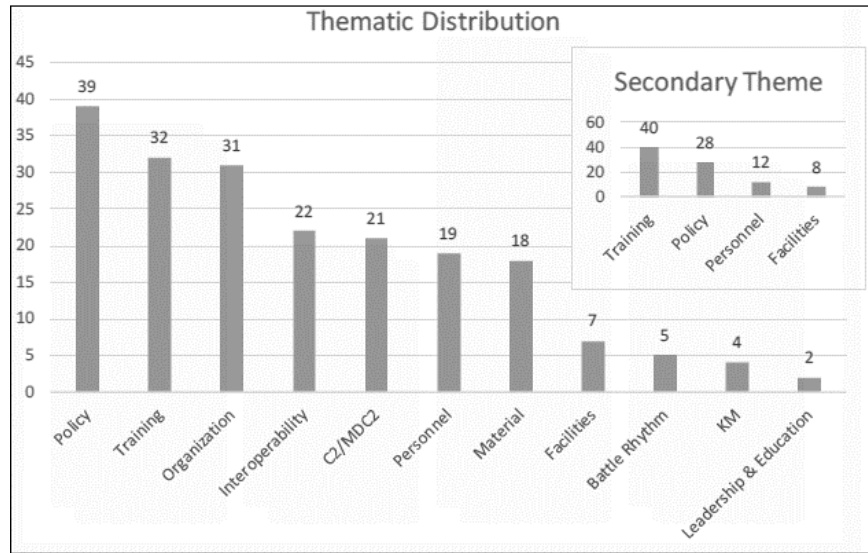


Figure 12. Case Study Collection Tool Results

Summative observations focused efforts. Observations submitted via the collaborative tool were distilled into key, summative observations, related to themes of policy and training. The observations highlighted the importance of shared tools and resources, as well as clarity in expectations, procedures, and lines of effort. This marks a departure from previous exercises, in which interoperability and organization were more commonly mentioned. Included in the total observation count are a number of *sustains*, or items recommended for continuance. The quantity of sustains reflects positively on the exercise, as this indicates that participants view exercise practice as effective.

In Exercise COPE NORTH 2018, the first year the tool was implemented, there were 221 observations and no sustains; in 2019, there were 179 observations and 11 sustains; and in 2020, there were 200 observations and 27 sustains. The total number of observations remained high, relative to previous years, with the number of sustains increasing. This indicates that exercise processes are improving, and that this last iteration was viewed more favorably by the training audience.

Iterative use resulted in thematic evolution. The nature of observations changed with successive use of the collection tool, as deliberate effort was made to refine the exercise and lessons learned approach. The focus areas for innovation shifted from immediate concerns related to beddown and early coordination in 2018, to resourcing to organizational structure in 2019, and now to training and policy moving forward from 2020. With each iteration, summative observations and trends were addressed by lead planners and improved upon. For example, the primary issues in 2019 related to interoperability (coordination) and organization structure, and so exercise planners designed and implemented a series of changes. These changes included new trilaterally integrated, function-based structures for both the exercise control group and humanitarian task force; the addition of civilian humanitarian participants; and aeromedical inter-fly opportunities on Japanese aircraft (PACAF/A9L, 2020). In general, the changes provided participants with unique insight to other organizations' practices, enabling the transfer of knowledge and providing initial touch points for innovation and benchmarking. The changes were well-received by the training audience, as indicated by the increase in sustains, and the shift in observation theme away from interoperability and organization structure.

5.4.4 Analysis

This study examined three research questions regarding how practitioners perceive and report exercise practice and performance outcomes. Patterns of inclusion and association varied between submitted observations and final reports, due in part to cultural factors and ambiguity.

While the observations submitted by exercise participants and the final reports included and discussed primary and secondary performance in a similar fashion, this pattern varied for innovation performance. Reports demonstrated a stronger preference for these topics than the observations, including three unique ties to innovation that were not made in any of the observations. Some of these additional sources were community-focused pre-briefs, which discussed team strategies, roles, and responsibilities; familiarization training; review and revision of guides, checklists and procedures.

The presence of unique ties to innovation indicates that reports aggregate from multiple formal and informal sources, and codify that information with a learning orientation, providing support for the Chapter IV recommendation to vary the mechanisms by which learning occurs. The learning orientation demonstrated in these reports contrasts with findings from the previous study, wherein some practitioners expressed a distrust of published reports, describing the documents as excessively biased, not particularly useful, or impacted heavily by the willful omissions of key insights. According to OLT, in order for the organization to benefit from individual learning, an individual must accept the new knowledge, effectively articulate this insight to others within the community, and take action for formal codification and aggregation to higher levels of the organization. Interviews indicated that cultural barriers, at times, restricted reporting. Some individuals did not have sufficient time to grow together in the exercise environment to fully accept the *espoused theory* of the learning process, although that appeared to be the exception.

The trilateral exercise setting allowed for exploring boundaries related to policy, which led to the identification of several service-specific operational requirements and

improved interoperability. Exercise learning supports active experiential learning that builds capabilities and adaptive skills and the development of shared mental models, which contribute to individual and team learning. Supportive growth and learning culture is especially important in these settings, where inter-organizational dynamics and time pressures can challenge the development of inter-organizational understanding and trust.

The Indo-Pacific strategy of the United States Department of Defense emphasizes building up mutually beneficial alliances with regional partners. Early and regular engagement, interoperability efforts, build closer relationships which can then be leveraged for improved performance outcomes in dynamic post-disaster settings. Not all parties were equally represented in the exercise. For example, the USAF hosted and was most prominent; RAAF participants occupied the majority of humanitarian control cell billets; and civilian humanitarian involvement was limited, both in scope and number. In such a setting, pre-established relationships can help curb the inclination toward suppression of expert knowledge. It is unclear whether power dynamics also discouraged participation or honesty in reporting.

Finally, study findings demonstrated progress made from the iterative use of a collaborative learning tool and the benefit of multiple learning mechanisms and partnerships, in support of Chapter IV recommendations. The lessons learned collection tool provided insight into the development of the exercise and the participant experience and perceptions; however, there were other formal and informal mechanisms utilized by different positions and sub-communities which fed formal reporting. Additionally, new opportunities for integration and interoperability training provided exercise participants with new experiences and perspectives. Collaborative learning was viewed favorably, as

indicated by the increased number of “sustains,” and serves to increase familiarity with operational partners, procedures, resources, and cultures for improved information sharing, resource pooling and goal alignment.

5.5 Discussion

Humanitarian logistics and operations management is complex, uncertain, and highly variable and further complicated by the lack of clear causal relationships between organizational practice and performance outcomes. To overcome these challenges, United States Indo-Pacific Command engages in numerous exercises and partnership programs in steady, pre-disaster phases (Department of Defense, 2019). Developing inter-organizational relationships during steady state supports dynamic response, by providing organizations opportunities “to align their operational strategies through standardized operations, inter-operability of activities and building trust through long term associations” (John et al, 2019: 1227). Experimentation and exercises are lauded, as these actions support a “virtuous cycle” of innovation (Department of Defense, 2019)

In this exercise case study, participants were encouraged to submit exercise observations documenting any issues or comments, along with any root cause or problem solving insights. When participant observations were statistically analyzed in contrast to final exercise reports, certain patterns emerged. Notably, innovation topics were emphasized more in reports than in observations, along with some new topics that were not included in the raw observations. This demonstrates how reports aggregate inputs from multiple sources, in support of variation of learning mechanisms. Additional field observations led to insights related to how inter-organizational relationships and cultural

factors influence reporting. Language barriers, jargon, and varying learning orientations each impacted whether individuals submitted observations. Additionally, role ambiguity complicated relationships between practice and performance outcomes, discouraging some participants from submitting insights.

The findings of the present study support Chapter IV recommendations. Variation of learning mechanisms is beneficial, as effective tools will be biased in some ways. Additional formal and informal mechanisms provide different perspectives, which can then be aggregated for final reporting. Additionally, collaboration and integration for learning provides the participants with unique opportunities for information sharing and building relationships. The iterative use of a collaborative lessons learned tool led to deliberate changes in the exercise design in support of the interoperability goals. Observations themes evolved as exercise and lessons learned tool matured.

5.5.1 Theoretical Implications

This study contributed to the academic study of logistics and operations management in humanitarian operational settings in several ways. This study utilized a broad range of practice and performance variables and a unique case study to examine learning and collaboration as key aspects of an effective operations management strategy. As such, this study contributed to the understanding of organizational learning, humanitarian operations management and humanitarian logistics theory.

The editorial process was scrutinized utilizing raw observations from participants, as well as published reports, providing insight into which observed topics and logistics or operations management practices, are not carried over into reports; how exercise participants perceive organizational practices and performance outcomes; and how this

translates to codified learning. Learning documents provided insight into how individual knowledge is codified for the organization, impacting subsequent dissemination, transfer and change behaviors. The learning documents in this study reflect the individual's recent experience, prior experience, and commitment to formalize new knowledge to push the organization forward. This provided insight into factors that moderate effective logistics and operations management, which include organizational culture and opportunities for collaboration.

5.5.2 Managerial Implications

For managers and practitioners this case study also provided useful, contextualized insights for improving steady state collaboration and learning. Results demonstrated how utilizing multiple learning mechanisms and creating new opportunities for collaborative learning can lead to innovation. These insights support the recommendations in Chapter IV. Furthermore, the effective use of a collaborative lessons learned tool enabled smart performance management in near-real time, reducing information delays and informing decision-making of current issues. Such tools must be supported by an organizational culture that emphasizes mastery over performance, as well as trusting relationships, in order to provide honest lessons for integration into the organizational body of knowledge. This study developed our understanding of humanitarian training effectiveness and applicability to real-world settings and can improve how organizations build knowledge from field exercises and how they engage with other stakeholders within the humanitarian space.

5.5.3 *Limitations and Future Research*

This study was limited in some ways by the exercise structure. For some participants, attention was split between the humanitarian scenario and the escalating combat flying scenario, which may have negatively impact the quantity or quality of observations. Furthermore, while civilian humanitarians were included in the planning and execution of the exercise, this play was limited by their small numbers and by the scenario and structures, which were not a true representation of military-civilian coordination in a real-world response.

How organizations foster a culture of learning can have a significant impact on innovation performance, both in terms of how the individual approaches related tasks and in how these resultant products are integrated and leveraged by the organization. In dynamic operational settings, a task focus detracts from team performance and effective collaboration. Further study should examine how learning culture can be bolstered in such environments, in support of greater collaboration, utilizing theories and methods common to industrial and organizational psychology.

Additional barriers to organizational learning include organizational cultures that are particularly risk-adverse. Experimentation and error-learning must be encouraged in order to effectively engage a training audience and develop the necessary adaption skills for expedient humanitarian response. Future research could examine how these training strategies could be incorporated into this environment. Alternately, adaptive risk mitigation or hedging strategies could be examined in dynamic operational settings, as well as other ways to reduce barriers to innovation in risk-adverse cultures. An examination of High Reliability Organizations may provide some generalizable insights.

VI. Conclusion

Effective logistics and operations management is critical to organizational success, but made difficult by uncertainty, variability, complex operating environments, and diverse stakeholder groups. The research presented in this dissertation focused on how logistics performance in complex humanitarian environments can be improved long-term by organizational investment in collaborative relationships and fostering a culture of learning. This dissertation sought to establish generalizable knowledge to clarify the relationship between organizational practice and performance outcomes; to apply this knowledge to humanitarian operational settings to examine factors that influence the relationship; and to examine organizational learning processes to enable more effective codification and transfer of information for performance improvement. Although a more detailed discussion can be found in each chapter, a summary of original contributions and suggestions for future research follows.

6.1 Original Contributions

Chapter II served to clarify conflicting results, providing general support for a positive relationship between quality and operations management practices and three categories of performance – primary, secondary, and innovation. This study took a more holistic view of practice, performance and document characteristic variables than previous research, and introduced structural equation modeling-based meta-analysis to the field of logistics in order to better address sample heterogeneity. The chapter concluded with recommendations for managers to implement diverse quality management programs with a holistic set of performance measures.

Chapter III provided an introduction to the humanitarian operating environment, creating a foundation for discussion of performance management and learning challenges and allowing for Chapter IV to contextualize Chapter II findings for the humanitarian environment. Chapter IV then examined organizational learning theory as a moderator for resource-based performance outcomes, especially the impact of an individual's *theory in use* and trust, cumulating in two recommendations for practitioners: to employ a variety of learning mechanisms and engage in collaborative learning networks.

Chapter V tests these recommendations with a unique military exercise case study and collaborative learning tool. Humanitarian research does not often explore exercise case studies or learning processes and mechanisms. As such, this study advances the understanding of how exercises may be employed for learning, and ways to narrow the gap between individual learning and codification as organizational knowledge in support of collaborative learning and network growth.

6.2 Implications for US Air Force Leaders

In addition to the original contributions listed above and managerial implications discussed in each chapter, this research also has important implications for United States Air Force leaders. Direct performance outcomes are convenient measures, which neglect important aspects of performance of interest to stakeholders. The most significant performance gains are often indirect; as such performance management systems should include a variety of measures, beyond those of direct operational outcomes.

United States military commitment to partners and allies in the Pacific region builds a strong foundation for humanitarian support post-disaster. Effectiveness in this

dynamic setting is contingent upon organizational learning that takes place before a disaster hits. Military leaders should continue to engage with regional partners, and especially civilian humanitarian organizations, in order to align goals and develop common operational pictures to better support aid beneficiaries, minimize loss of life and human suffering. During and after humanitarian operations, military leaders should act to encourage honest reporting, fostering a mastery mindset focused on growth and organizational improvement. Regular engagement with partner organizations builds trust and encourages honesty and deliberate effort toward group goals.

These lessons can be extended to other dynamic operating environments, including the global military supply chain. Recent Headquarters Air Force pushes for innovation, including the AFWERX accelerator, Maintenance NEXT, and the Tesseract Office of Innovation demonstrate top-down support for logistics innovation, which should be reinforced at lower levels. Additionally, these efforts cannot be solely focused on technical logistics processes, but must also consider underlying collaborative relationships and organizational culture that can propel an organization forward for innovation and long-term success.

6.3 Suggested Future Research

Further studies should examine other factors that impact how organizational practice impacts performance outcomes in dynamic settings. These studies could further develop or refine the mechanisms by which organizational learning moderates resource-based capabilities and resultant performance outcomes. Combining other theories can provide new insights for theory building in humanitarian performance.

Next, studies should be undertaken to investigate learning and collaboration topics with relevance for practitioners. Specific techniques that can maximize training value and support relationship building. Strong personal ties between members of different communities may provide additional motivation to deliberately improve the partnership and network performance. Furthermore, research into supportive organizational culture (e.g., mastery orientation for learning, experimentation and risk taking) could minimize exclusion of key topics in reporting and increase honesty and innovation.

Although this research provides important contributions to understanding collaboration and learning for humanitarian logistics and operations management, there is much more to be learned. Research that improves performance management in humanitarian settings can mitigate loss of life and human suffering. This is, and will remain, one of the most critical altruistic endeavors.

Appendix

A.1 Primary Sources Included in Meta-Analysis

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A.2 Meta-Analysis Study Classification Sample

Study	Journal	Independent Variable	Practice	Dependent Variable	Performance	Effect Size	Sample Size
Mehra and Inman (1992)	Decision Sciences	Management Commitment	Behavioral	JIT Operational Performance	Primary	0.008	114
		JIT Production	Technical	JIT Operational Performance	Primary	0.445	114
		JIT Vendor Strategy	Collaborative	JIT Operational Performance	Primary	0.393	114
		JIT Education Strategy	Behavioral	JIT Operational Performance	Primary	0.039	114
Swink, Narasimhan and Kim (2005)	Decision Sciences	Product-Process Development	Technical	Market-Based Performance	Secondary	0.650	57
		Product-Process Development	Technical	Cost Efficiency	Primary	0.280	57
		Product-Process Development	Technical	Process Flexibility	Primary	0.629	57
		Product-Process Development	Technical	New Product Flexibility	Innovation	0.460	57
		Supplier Relationship	Collaborative	Market-Based Performance	Secondary	0.294	57
		Supplier Relationship	Collaborative	Cost Efficiency	Primary	-0.087	57
		Supplier Relationship	Collaborative	Process Flexibility	Primary	0.360	57
		Supplier Relationship	Collaborative	New Product Flexibility	Innovation	0.283	57
		Workforce Development	Behavioral	Market-Based Performance	Secondary	0.809	57
		Workforce Development	Behavioral	Cost Efficiency	Primary	0.271	57
		Workforce Development	Behavioral	Process Flexibility	Primary	0.522	57
		Workforce Development	Behavioral	New Product Flexibility	Innovation	0.505	57
Cho, Jung and Linderman (2017)	International Journal of Production Economics	Managerial Commitment	Behavioral	Quality Outcome	Primary	0.284	152
		Managerial Commitment	Behavioral	Customer Satisfaction	Secondary	0.527	152
		Managerial Commitment	Behavioral	Business Performance	Secondary	0.252	152
		Customer Involvement	Collaborative	Quality Outcome	Primary	0.253	152
		Customer Involvement	Collaborative	Customer Satisfaction	Secondary	0.553	152
		Customer Involvement	Collaborative	Business Performance	Secondary	0.330	152
		Strategic Planning	Technical	Quality Outcome	Primary	0.230	152
		Strategic Planning	Technical	Customer Satisfaction	Secondary	0.424	152
		Strategic Planning	Technical	Business Performance	Secondary	0.275	152
...							

A.3 Meta-Analysis Study Effect Size Transformation Sample

Study	Sample Size	Effect Size	Transformed ES (Z_r)	Standard Error (SE)	Weight (w)	wES ($w*Z_r$)	wES ² ($w*(Z_r^2)$)	Z_i
Mehra and Inman (1992)	114	0.008	0.008	0.095	111	0.928	0.008	0.088
	114	0.445	0.478	0.095	111	53.088	25.390	4.687
	114	0.393	0.415	0.095	111	46.078	19.127	4.138
	114	0.039	0.039	0.095	111	4.349	0.170	0.413
Swink, Narasimhan and Kim (2005)	57	0.650	0.775	0.136	54	41.828	32.400	4.774
	57	0.280	0.287	0.136	54	15.515	4.458	2.055
	57	0.629	0.740	0.136	54	39.946	29.550	4.622
	57	0.460	0.498	0.136	54	26.866	13.367	3.382
	57	0.294	0.303	0.136	54	16.359	4.956	2.160
	57	-0.087	-0.087	0.136	54	-4.715	0.412	-0.640
	57	0.360	0.377	0.136	54	20.378	7.690	2.649
	57	0.283	0.290	0.136	54	15.683	4.555	2.076
	57	0.809	1.123	0.136	54	60.646	68.111	5.942
	57	0.271	0.277	0.136	54	14.983	4.157	1.988
	57	0.522	0.579	0.136	54	31.246	18.080	3.833
	57	0.505	0.556	0.136	54	30.047	16.719	3.713
Cho, Jung and Linderman (2017)	152	0.284	0.292	0.082	149	43.546	12.726	3.469
	152	0.527	0.586	0.082	149	87.370	51.232	6.436
	152	0.252	0.257	0.082	149	38.300	9.845	3.070
	152	0.253	0.259	0.082	149	38.584	9.991	3.092
	152	0.553	0.623	0.082	149	92.848	57.858	6.754
	152	0.330	0.343	0.082	149	51.146	17.556	4.033
	152	0.230	0.234	0.082	149	34.884	8.167	2.807
	152	0.424	0.452	0.082	149	67.406	30.494	5.174
	152	0.275	0.283	0.082	149	42.109	11.901	3.361
...								
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B.1 Cumulative Case Study Interview Guide

Positioning Questions:

- 1) Can you tell me a bit about your organization?
- 2) What is your current position?
- 3) How long have you worked for your current organization? In the field?

Open section on Goal Setting and Metrics:

- 4) Describe your organization's supply chain goals.
- 5) What does "successful supply chain performance" look like for your organization?
- 6) What metrics are tied to these performance goals?
- 6a) Does your organization track performance or progress toward those goals?

Open section on Organizational Learning:

- 7) Can you describe your organization's continuous improvement programs?
- 7a) How are these lessons integrated into organizational practice?
- 7b) Do you feel that this process improves your organization's ability to fulfill its mission?

Open section on Transition Practices and Coordination:

- 8) When your organization engages in a new project, what are some best practices for startup?
- 8a) How are lessons learned from previous projects employed here?
- 9) What does "successful startup" look like?
- 9a) Does your organization set any goals for this phase?
- 9b) Does your organization track performance or progress toward those goals?
- 10) As your organization begins to transition out, what are some best practices for handover?
- 10a) How are lessons learned from previous projects employed here?
- 11) What does "successful handover" look like?
- 11a) Does your organization set any goals for this phase?
- 11b) Does your organization track performance or progress toward those goals?

Closing section (NOTE: Asked if relevant and not yet addressed.)

- 12) What would you do differently in order to improve learning in your organization?
- 13) What are some truly effective, or ineffective, strategies that you have seen in your organization or others? (With respect to organizational learning, performance management, goal setting, etc...)
- 14) What is the most important resource for practitioners (in terms of performance)?
- 15) What can help stabilize communities, or help results from humanitarian efforts endure?
- 16) What is the difference between humanitarian organizations that are generally successful and those that are not?
- 17) What is the biggest obstacle to lasting performance outcomes?

C.1 Case Study Interview Guide

EXERCISE COPE NORTH 2020 Key Personnel Lessons Learned Interview Questionnaire

The following questions are provided in preparation for your interview with the Lessons Learned Team. The intent is to present a concise picture of the challenges and successes to senior leader in order to facilitate best practices or taskings for areas of improvement. Please try to keep your answers at the **unclassified** level. If your responses need to be classified at a higher level please coordinate your responses with the U.S. Lessons Learned Team Lead.

This questionnaire is strictly a guide and does not need to be filled out prior to the interview.

1. What are one or two major issues and/or challenges (“Big Rocks”) you faced that rise to the PACAF, PACOM, or respective coalition Higher Headquarters interest during the CN20?
2. What are some of the success and/or shortfalls you had regarding C2 (command and control) during this exercise? Do you have any recommendations for further enhancing these relationships in the future?
3. If you conduct activities with coalition partners during CN20? What, if any, issues did you face with respect to interoperability/capability gaps/communications processes and do they warrant further attention or follow-on actions?
4. How realistic was the exercise construct in providing effective training to meet exercise goals and objectives?
5. How effective was the coordination between U.S., Coalition Partners, and other agencies (DoS, DFAT, NGOs, etc.) participating in this exercise?
6. What other lessons we can learn from this exercise?

C.2 Case Study Collection Tool User Interface

Event Name *	Cope North ▼ Name of the event the practice or issue was observed
Event Type *	Exercise ▼
Event Year *	2020 Year of the event or exercise
Locations *	Andersen ▼ Please select the location of the observation
Observation Type *	▼ Is this a new issue, a repeat problem, or something that needs to be continued?
Obs Category *	US, JPN, & FVEY ▼ Is this issue a U.S. issue only or a coalition issue? Pick the one that applies
Overall Classification *	UNCLASSIFIED ▼ Please select an overall classification for this observation. If you need to discuss higher level classification material please contact a Lessons Learned Representative before submitting an observation
Overall Rel To Caveat	▼
Title/Topic Classification *	UNCLASSIFIED ▼ Please select the classification level of the title/topic
Title/Topic Rel To Caveat	▼
Title/Topic *	 (Enter a short title/topic for the observation)
Observation Classification *	UNCLASSIFIED ▼ Please select a level of classification for this section
Observation Rel To Caveat	▼
Observation *	 Click for help about adding basic HTML formatting. (Describe the issue or best practice. Provide the basic 5W's; Who, What, When, Where, and Why)
Discussion Classification *	UNCLASSIFIED ▼ Please select a level of classification for this section
Discussion Rel To Caveat	▼
Discussion *	 Click for help about adding basic HTML formatting. (Expand on the issue or best practice)
Recommendation Classification *	UNCLASSIFIED ▼ Please select a level of classification for this section
Recommendation Rel To Caveat	▼

Recommendation *	Click for help about adding basic HTML formatting. (What is your recommendation for improvement or recommended solution?)
Suggested OCR(s)	 Please add suggested OCRs if applicable
First Name *	 First name of the person submitting this observation
Last Name *	 Last name of the person submitting this observation
Rank *	☒ ☐ Specify your own value: Please select your rank/grade from the list. If you are a coalition partner please enter the name of your nation and your rank separated by a slash "/"
Exercise/Event Role *	 What was your role or position for this event
DSN (Optional)	 Optional: Please enter your DSN Phone number if available
Commercial Phone (Optional)	 Please provide a phone number if you wish to be contacted regarding your observation
Email (Optional)	 Optional: enter email address, phone, etc., only if you would like someone to contact you about this lesson learned
Input Source *	LL Tool (APAN)
Vetted	Yes This field is for LL Observers Only
Resolution Status	Not Referred This is for LL Observers only please don't fill in any information in this area
Input By (LL Observer)	 This field is for LL Observers Only
Observation Theme	 This field is for LL Observers Only
Secondary Observation Theme	 This field is for LL Observers Only
COMPACAF Priorities	 This field is for LL Observers Only
Service Affiliation *	☒ ☐ Specify your own value:
Unit of Assignment	 What unit are you assigned to

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14. ABSTRACT Logistics is dynamic, expansive, and critical to organizational success. While it is generally believed that effective logistics management is associated with positive performance outcomes, the links between organizational practice and performance are understudied. This dissertation leverages resource-based theory and organizational learning theory to examine organizational practice and performance in non-traditional logistics settings, with particular focus on military organizations and humanitarian operational settings. First, a meta-analytical study establishes generalizable associations between various operations management practices and performance outcomes. Then, this is applied to dynamic humanitarian logistics settings, exploring how practitioners perceive practice and performance, and how this is reported and documented for organizational performance improvement. A cumulative case study provides actionable recommendations for humanitarian practitioners and insights into an understudied area of performance management and organizational learning, which are then examined in-depth in a humanitarian field exercise. This dissertation demonstrates the importance of deliberate resource alignment, collaboration and learning for lasting logistics operations management success. To address these gaps, this dissertation 1) establishes generalizable associations between various organizational practices and performance outcomes; 2) applies this insight to humanitarian logistics settings, exploring how practitioners perceive practice and performance; and 3) examines how these associations are codified for organizational improvement.					
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