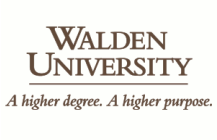

2018

Aligning Social Media, Mobile, Analytics, and Cloud Computing Technologies and Disaster Response

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This is to certify that the doctoral dissertation by

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has been found to be complete and satisfactory in all respects,
and that any and all revisions required by
the review committee have been made.

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Walden University
2017

Abstract

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by

William Worthy

MA, Webster University, 2001

BS, Fayetteville State University, 1999

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Management

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Abstract

After nearly 2 decades of advances in information and communications technologies (ICT) including social media, mobile, analytics, and cloud computing, disaster response agencies in the United States have not been able to improve alignment between ICT-based information and disaster response actions. This grounded theory study explored emergency response ICT managers' understanding of how social media, mobile, analytics, and cloud computing technologies (SMAC) are related to and can inform disaster response strategies. Sociotechnical theory served as the conceptual framework to ground the study. Data were collected from document reviews and semistructured interviews with 9 ICT managers from emergency management agencies in the state of Hawaii who had experience in responding to major disasters. The data were analyzed using open, axial coding, and selective coding. Three elements of a theory emerged from the findings: (a) the ICT managers were hesitant about SMAC technologies replacing first responder's radios to interoperate between emergency response agencies during major disasters, (b) the ICT managers were receptive to converging conventional ICT with SMAC technologies, and (c) the ICT managers were receptive to joining legacy information sharing strategies with new information sharing strategies based on SMAC technologies. The emergent theory offers a framework for aligning SMAC technologies and disaster response strategies. The implications for positive social change include reduced interoperability failures between disaster agencies during major catastrophes, which may lower the risk of casualties and deaths to emergency responders and disaster victims, thus benefiting them and their communities.

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Dedication

I dedicate this dissertation to my family, to my mother, none of this would have been possible without your love and support throughout my entire life. To my aunts, uncles, and cousins from whom I drew inspiration and motivation to begin my doctoral journey. To my aunt Terry, you may not be with us anymore, but you blazed the trail for me. You inspired me to dream of attending college. Finally, I dedicate the completion of this dissertation to my friends and professional colleagues. I thank you for your unwavering encouragement throughout this project.

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Chapter 1: Introduction to the Study

Alignment between information and communications technology (ICT) and business is an indicator of high performing organizations (Wu, Straub, & Liang, 2014). The definition of strategic alignment has been the ability of businesses to leverage ICT to accomplish a strategic aim (Turban, Volonino, & Wood, 2013). For instance, business leaders would set goals for their organization, and then the ICT department implements ICT to achieve their targets (Wu et al., 2014). If the organization met their desired goals, then the organizations considered strategic alignment a success.

Advances in ICT, such as the convergence of social media, mobile, analytics, and cloud computing (SMAC) technologies, are upending the definition of strategic alignment between ICT and business strategy (Dyché, 2015; Shelton, 2013). This transformation in strategic alignment has led to disruptions in business models, communication patterns, and politics (Dyché, 2015; Shelton, 2013). Some organizations are now leaders in their sectors because they are ICT-centric organizations (Dyché, 2015). Organizations enabled by SMAC technologies thrive because they take advantage of data created by SMAC technologies, they create the products and services that comprise SMAC technologies, or they innovate their processes using SMAC technologies. For example, organizations in the entertainment industry took advantage of SMAC technologies to deliver music directly to user's mobile devices. The effect on music and video stores carrying physical inventory has been to change rapidly or go out of business.

Although SMAC technologies have been the cause for many organizations to reconsider how they use ICT to compete, public bodies such as disaster response organizations continue to operate ICT based on concepts from the 1970s in support of outdated strategies (Brattberg, 2012). In the United States, disaster response agencies are behind in implementing SMAC technologies, because the ICT first responders depend on do not align with SMAC technologies and disaster response agencies are unable to execute mandated disaster response strategies (Brattberg, 2012; Laakso & Palomäki, 2013; Vassiliou & Alberts, 2013).

Chapter 1 includes the problem in detail by including the background on the problem, problem statement, purpose of the study, research questions, conceptual framework, nature of the study, definition of terms, assumptions, limitations, scope, delimitations, and significance.

Background of the Study

In the United States, federal laws prescribe disaster response, and disaster response organizations must follow an explicit set of rules or lose resources from the federal government (Wise, 2009). In 1988, Congress signed the Robert T. Stafford Disaster Relief and Emergency Assistance Act into law, which gives the president of the United States the authority to declare an emergency and permits federal agencies to provide resources to states affected by a disaster (The Stafford Act, 2013). However, all disasters begin as local events (Drouglazet, Rajamäki, Tyni, & Aro, 2014). In the event a local disaster event escalates, a major disaster is declared, and first response agencies must coordinate their actions with other types of organizations and across other geographical jurisdictions (Trakas, 2012). However, a single disaster response

organization's resources can become overwhelmed (Cabinet Office, 2012; Scholl, Patin, & Chatfield 2012).

For disaster response agencies to work together during a major disaster, first responders must share information between agencies (Scholl et al., 2012). Information sharing between first response agencies must be prompt (Owen et al., 2013) and understandable by all involved (Scholl et al., 2012). Typically, first responders use handheld radios to share information between agencies and across jurisdictions (Goldstein, 2012); however, first responders' radios have limitations because they only can transmit voice and small amounts of data (Goldstein, 2012). First responders' radios can operate alone over short distances but normally rely on additional equipment to interoperate with external agencies, which are not scalable in the aftermath of a catastrophe.

The interoperability limitations of first responders' radios have resulted in more than one tragedy. During the September 11, 2001, terror attacks in the United States, 121 firefighters unnecessarily lost their lives in addition to the more than 2,000 citizens and other first responders (Kean & Hamilton, 2004). Four years later, during Hurricane Katrina, the entire ICT infrastructure, upon which first response organizations depended, was destroyed (Oh, 2012). The destruction of the ICT infrastructure contributed to delays in the response that lasted beyond the disaster (Oh, 2012).

After the terror attacks in 2001, or more commonly known as 9/11, the Department of Homeland Security (DHS) mandated improvements in interoperability between first response agencies to prevent future interoperability failures. The purpose of the SAFECOM program was to centralize the funding of technology, research, and

development, as well as centralize subject-matter-experts and training on ICT designed to improve interoperability between state and local first responders (Drouglazet et al., 2014). In addition, PROJECT25, a component of the SAFECOM program, focused on improving first responders' radios.

Due to interoperability failures including the ones during the 9/11 terror attack and Hurricane Katrina, significant changes in disaster response strategy were made by the federal government. Disaster management frameworks mandate the coordination of disaster response actions by disaster response agencies. The DHS mandates all state and local emergency response agencies follow the guidelines in disaster management frameworks to enable interagency first response organizations to work together in a seamless and coordinated manner (Brattberg, 2012). The National Incident Management System (NIMS) contains the standard operating procedures first responders follow during a major catastrophe (Brattberg, 2012). The National Response Framework (NRF) describes the concept of a whole community approach to preparing and responding to major disasters (Federal Emergency Management Agency, 2015). The Incident Command System (ICS) is a management system used to integrate resources at the incident level (Federal Emergency Management Agency, 2014a).

Despite the effort to change disaster response strategies, I discovered that mandated disaster management frameworks and ICT initiatives had not delivered the intended results. Jensen and Waugh (2014) claimed that disaster management frameworks and incident management systems were not useful because major disasters were often unpredictable events. In the initial phases of a major disaster, first responders are forming temporary organizations and improvising the disaster response effort rather

than following a plan (Allen, Karanasios, & Norman, 2014; Ley, Pipek, Reuter, & Wiedenhoefer, 2012; Vassiliou & Alberts, 2013). Unexpectedly, ad-hoc formations of first responders at some point in the disaster effort will exceed the capacity of their ICT, or information sharing breaks down (Kruke & Olsen, 2012; Ley et al., 2012; Oh, 2012).

The lack of leadership by disaster response managers is one reason for the failure of disaster management frameworks and interoperability initiatives. Interoperability between ad-hoc formations of first responders is not a problem during low consequence or everyday events (Vassiliou & Alberts, 2013). Laakso and Palomäki (2013) found that leaders overlooked major disasters or complex catastrophes. Instead, first response organizations focused on training exercises, which only consisted of small-scale activities with typical scenarios. Hence, Laakso and Palomäki argued that interoperability failure was a problem because disaster response organizations' choice of ICT reflected how they prepared for disasters. Interoperability failure between interagency first responders is a persistent problem because first response organizations' radios are not adaptable to the information sharing needs of nonroutine catastrophes (Laakso & Palomäki, 2013). Lack of understanding and sense of urgency are also problems, which can happen due to first responders from various agencies using different terminology, leading to miscommunication and skewed reactions to information (Laakso & Palomäki, 2013). However, the cause of most information sharing problems during disasters, according to Palttala, Boano, Lund, and Vos (2012), was the timeliness of sending information.

Disaster response organizations do not have the same requirement to increase alignment between ICT and business as do private organizations, but they have a mandate enforceable by law to respond to disasters (Vogt, Hertweck, & Hales, 2011); however,

interoperability problems may exist because of misalignment between first responders' ICT and disaster response strategies. Vogt et al. (2011) concluded the size of the disaster response organization determined the quality of ICT management processes. Large disaster response organizations had sound ICT management procedures in place, while smaller disaster response organizations had almost no ICT management systems in place. Therefore, ICT managers had trouble determining the value of advancement in ICT on disaster response strategies. The central reason was that ICT managers and first responders did not collaborate nor did they trust one another. The animosity between ICT managers and first responders had built up through the ICT failures that first responders experienced during past disasters (Vogt et al., 2011).

Similar research conducted by Weyns and Höst (2009) found that traditional alignment frameworks overlooked the specialized ICT needs of public organizations such as disaster response organizations. Some first responders were wary of ICT to the point that they built their disaster response plans around not having to use ICT. The problem became more difficult because ICT managers would not guarantee first responders' ICT would operate during a disaster. Conversely, some first responders did not know where ICT fit in their disaster response plans, as ICT managers and first responders did not have a process in place to share ideas and concerns.

Researchers could address the disaster response management problems that disaster response agencies face in the United States. At the time of data collection for this study the latest ICT initiative to supersede SAFECOM and PROJECT25 is FirstNet. FirstNet will be a single broadband network that spans the entire United States for the sole use of first responders during emergencies (Peha, 2013). FirstNet must overcome

several challenges. The first challenge is the estimated cost to complete FirstNet is between $13 and $45 billion (Moore, 2016; Peha, 2013). Second, FirstNet initially does not provide any new capabilities for first responders. The existing ICT systems that first responders depend on will remain as their primary ICT after the completion of FirstNet. Third, because of the first two challenges, individual states have the option of turning down participation in FirstNet if they can produce a better plan to improve interoperability than the federal government provides (Goldstein, 2012).

Peha (2013) recommended a public-private relationship between first response agencies and telecommunications businesses to mitigate the costs of financing FirstNet. For disaster response agencies, they would have a scalable ICT architecture to use in the event of a disaster while private ICT providers could use the network to extend broadband to more citizens (Goldstein, 2012). Congressional reports found that disaster response agencies did not trust private companies would keep their commitments to disaster response organizations in the event of a catastrophe. Equally, private companies do not trust the government because they did not want to be compelled to expand their network capacity in huge numbers without guarantees of a market for the network capacity (Goldstein, 2012). Hence, the lack of concensus between the government and the private sector leaves disaster response organization across the nation without a viable solution and potential benefits to citizens.

Advances in ICT, such as SMAC technologies, would mean significant changes for the future of disaster response. In the context of disaster response, SMAC technologies may provide similar shifts in strategy. SMAC technologies could improve situational awareness, command, and control of disasters by collecting data. Second, the

power of SMAC technologies will shift the advantages of ICT from first responders to the disaster victims and globally distributed volunteers (Griswold, 2013). Because of the revolutionary changes in outcomes created by SMAC technologies, SMAC technologies and disaster victims could improve first response organization ability to collaborate across organizational borders (Griswold, 2013).

A potential issue in implementing SMAC technologies is that decision makers and first responders from disaster response agencies from the United States Department of Defense and the states do not seem to consider themselves knowledgeable enough about SMAC technologies (Abbasi, Kumar, Andrade Filho, & Liu, 2012; Bressler et al., 2012; San Su et al., 2013). In addition, decision makers and first responders did not trust the technology nor the users. First responders were not prepared to respond to a request for help from disaster victims via social media (Bressler et al., 2012). State and local first responders had an awareness of social media, but they could not respond to a disaster based on social media (San Su et al., 2013).

Interoperability between the 74,000 first response agencies in the United States (Gorcin, 2014) is costly to improve and to maintain, but the occurrence and magnitude of natural and human-made disasters are increasing (Comfort, Waugh, & Cigler, 2012). States, such as Hawaii, Alaska, Tennessee, and Missouri, are at a high risk for earthquakes (National Earthquake Hazards Reduction Program, 2015), and Hawaii has a high risk for tsunamis (Wise, 2009). In the event of a major disaster and the state of Hawaii's governor requests a presidential declaration of a catastrophe, the response effort takes on new complexity as the resources to support the response efforts will come from the continental United States (Federal Emergency Management Agency, 2014e). Despite

the need for better interoperability, there is misalignment between first responder's ICT and disaster response strategies. Consequently, the unpredictable nature of disasters makes traditional ICT alignment used in commercial industry insufficient for disaster response organizations (Vogt et al. 2011). Therefore, it was necessary to conduct additional research to explore ICT manager's level of understanding of alignment between SMAC technologies and disaster response.

Problem Statement

Disaster response agencies are unable to align their ICT with their emergency response strategies during a major crisis (Vogt, 2012). Disaster response agencies in the United States continue to operate thousands of separate ICT networks, which are incompatible and will cost 10s of billions of dollars to fix (Goldstein, 2012; Moore, 2016; Peha, 2013). Information about what disaster response managers know about aligning SMAC technologies and disaster response strategies appears to be lacking and represents a gap in disaster response organizations' preparedness to interoperate with SMAC technologies during major disasters (Vogt et al., 2011). Due to this lack of knowledge, in this study I explored ICT managers' knowledge and experience aligning SMAC technologies with disaster response strategies. The results of this study led to a new framework, which might provide strategies for disaster response managers and first responders that may improve the value of SMAC technologies to members of emergency management organizations.

Purpose of the Study

The purpose of this qualitative grounded theory study was to explore ICT managers' level of understanding of how social media, mobile, analytics, and cloud

computing technologies (SMAC technologies) are related to and can inform disaster response strategies. Despite disaster response organizations in the United States dependency on interoperable ICT during major disasters, ICT initiatives intended to support national disaster response strategies were financially and technically flawed (Goldstein, 2012; Hallahan & Peha, 2013; Moore, 2016). Interoperating with SMAC technologies and disaster victims may mitigate some of the shortcomings, but decision makers and first responders argued against SMAC technologies because they would need subject matter experts to understand the technology and data.

From practical experience and reviewing the literature, I knew research was needed on using SMAC technologies. Opinions about alignment between SMAC technologies and disaster response from disaster response organizations ICT managers' was unknown. I interviewed nine experienced ICT managers to explore their standard of understanding of the aligning SMAC technologies based on the perspective of the ICT managers. The findings from this study led to a framework that could potentially contribute to a future theory which might improve the value of interoperability initiatives and usefulness of disaster response frameworks.

Research Questions

Research questions typically emerge after the literature review (Myers, 2013). I included an overarching research question and two subresearch questions to attempt to generate a new theory of SMAC technologies and disaster response. The overarching research question for this study and the two subresearch questions are below:

RQ1: What is the level of understanding of alignment between SMAC technologies and disaster response strategies for ICT managers from disaster response agencies?

SQ1: How does the prevalence of SMAC technologies influence ICT managers' perspectives toward ICT initiatives and disaster management frameworks?

SQ2: How can exploring ICT managers' level of understanding of alignment between SMAC technologies and disaster response generate a new theory?

Conceptual Framework

Trist and Bamforth's sociotechnical theory served as the conceptual framework to explore the disaster agency ICT managers' understanding of alignment between SMAC technologies and disaster response strategy. Trist and Bamforth wrote about the effects of mechanization in British coal mines, identifying a relationship that existed between technology and people (Trist, Higgin, Murray, & Pollack, 1963). A system is a set of interrelated elements or components that work together to achieve an overall objective (Gieger, Rosemann, Fielt, & Schader, 2011). A sociotechnical system is a system that consists of people, knowledge, physical equipment, communication tools, and various interconnecting systems (Lu, Xiang, Wang, & Wang, 2011). The people associated with the system and the conditions the systems work under are considered one (Kim, Sharman, Cook-Cottone, Rao, & Upadhyaya, 2012). Conversely, by definition, alignment lies at the intersection of ICT and business, and the perspective is that alignment is mainly a managerial and a technical issue (Howson & Hammond, 2014; Turban et al., 2013).

Different interpretations of sociotechnical theory exist. Ciborra (1999) demonstrated sociotechnical approaches shift the attention toward recognizing the effects of unpredictable actions on a system, such as an improvisation, by the users. Sociotechnical theory serves as a lens to explore social and technical factors as a cause of interoperability failure (Fedorowicz et al., 2014). For instance, sociotechnical theory acts as a lens to consider social and technical factors as a cause of failure rather than a singular focus on technical factors (Fedorowicz et al., 2014).

SMAC technologies are more than simply a set of technologies; they are also a sociotechnical system (Shelton, 2013). Mobile is the device used to connect, but it also refers to the ability of the user to collect, process, and share information when, where, and with whom people choose (Sherchan et al., 2012). Researchers and practitioners consider cloud computing a way of doing things or a mindset rather than technology alone (Browning, 2014). I present a more detailed discussion of the sociotechnical theory in Chapter 2.

Nature of the Study

I choose a qualitative research paradigm to conduct this study because of technical, human, and organizational perspectives regarding aligning SMAC technologies with disaster response strategies. I used the grounded theory research design from Glaser and Strauss (1967) to explore ICT manager's perspectives on alignment between SMAC technologies and disaster response actions. A grounded theory approach allows the development of a theory based on the collection of data rather than data being dependent upon how the theory is generated (Glaser & Strauss, 1967).

I considered a quantitative research method for this study, but I chose a qualitative research method because the focus of quantitative research is the measurement and analysis of the relationships between independent and dependent variables (Denzin, & Lincoln, 2011). However, I was not intent on measuring the degree of alignment between SMAC technologies and disaster response nor was I determining if there was a relationship between SMAC technologies and the effectiveness of disaster response. I sought to illustrate an aspect of the problem from the perspectives of individuals in a given situation that had not received much exploration (Stake, 2010).

I also considered mixed methods research methodology. Mixed methods is a third research method that combines qualitative and quantitative methods (Gorard & Taylor, 2004; Johnson & Onwuegbuzie, 2004; Teddlie & Tashakkori, 2009). The combination of qualitative and quantitative designs complements one another (Teddlie & Tashakkori, 2009); however, I did not choose a mixed methods research methodology because a single method answered the research questions in this study. I sought to understand the knowledge and experiences of disaster agency ICT managers in the real-world context of aligning SMAC technologies with the execution of disaster response strategies (Patton, 2015).

Qualitative research designs include case studies, ethnography, grounded theory, and phenomenology (Teddlie, & Tashakkori, 2009). I did not choose ethnography—an in-depth study of phenomenon characterized by extensive fieldwork (Myers, 2013)—because ethnography would have required me to be knowledgeable on cultural anthropology and possess expertise of social-cultural systems (Denzin, & Lincoln, 2011). Furthermore, I was not seeking to examine the cultural aspects of a group of people. I did

not choose phenomenology, which seeks a participant's view on social phenomenon based on experience (Dowling, 2007), because the intent of conducting this study was not to describe the personal experiences of the participants (Donnelly & Trochim, 2007). Grounded theory is a method in which researchers use to create a theoretical framework from a phenomenon for which small amounts of research exist or is hard to explain (Glaser, 1992). In this study, the grounded theory approach used purposive sampling and open-ended question to interview ICT managers. This strategy allowed participants to provide background and current information on the phenomenon of interest.

I collected data by a review of relevant documents and conducting semistructured interviews with a sample of ICT managers from a disaster response agency. Lodico, Spaulding, and Voegtle (2010) defined an interview as a purposive conversation where the participants express their thoughts in their own words. The interview process followed a strict interview protocol (see Appendix A). I asked 10 open-ended questions from an interview questionnaire (see Appendix B) created by me. I transcribed the recorded interviews and returned the transcript to the participants for them to ensure accuracy and to verify the findings (Houghton, Casey, Shaw, & Murphy, 2013). I conducted interviews until I reached saturation of data (Bryman, 2012). Because this was a grounded theory study, I reached saturation because no more information could be added to the formation of a theory (Walker, 2012). In addition to the interviews, I reviewed relevant documents collected from the participants' organization using a document review matrix (see Appendix C) created by me. The purpose of the document review was to strengthen the collection of data from the interviews.

The Delphi technique gathers the knowledge, expertise, and opinions of a select panel of experts to create a consensus on a real-world topic (Dalkey & Helmer, 1963). The Delphi panel included four experts in managing various aspects of ICT during a major crisis. I used the Delphi technique to ensure the interview protocols were present and in the correct sequence; the interview questions were understandable by the participants, and the document review matrix headings captured the right information from the documentation.

I analyzed data using Qualitative Data Analysis Software (CAQDAS) to aid me to organize and categorize data collected from the interviews and the document review (Merriam, 2009). I used NVivo11 for coding, themes, and classification of data. NVivo11 is a software application, which researchers use to code and analyze structured and unstructured (e.g., audio-visual files, text, and images) forms of data (Sotiriadou, Brouwers, & Le, 2014). I uploaded the audio and interview transcriptions from each participant into NVivo11 after a review by each participant (i.e., member checking). I used open coding, axial coding, and selective coding to organize the data into categories (Corbin & Strauss, 2008). I used constant comparative analysis to reveal the first categories and refine the categories until a theory emerged (Glaser & Strauss, 1967).

Merriam (2009) explained that the sample size should reflect an adequate number to answer the research questions. A purposive sample of nine disaster agency ICT managers from a disaster response agency in the state of Hawaii participated in semistructured interviews. In addition, the participants provided electronic documentation to support their opinions from the interviews. The ICT managers I selected to participate in this study had a minimum of a 1 year experience and, at the time of data collection,

worked directly with supporting ICT between emergency response agencies. The rationale was the ICT manager would have taken part in at the minimum of one disaster response exercise and have a basic understanding of interoperability challenges.

At the time of data collection, I was an ICT project manager in an information technology division for a Department of Defense agency. I was responsible for ICT projects designed to improve interoperability between the agency I worked for and a variety of federal, international, and nongovernmental organizations. The exception was that I had no direct experience providing solutions to disaster response agencies. However, my personal and professional experiences did not influence data collection and analysis. I took notes in a reflective journal throughout the data collection and analysis process (Tufford & Newman, 2012). In addition, I used triangulation and member checking to ensure the consistency of the collection of data (Patton, 2015).

I explored disaster agency ICT managers' attitudes towards alignment between SMAC technologies and disaster response. The research questions served as the basis for this research study and for creating the interview questions. A more detailed discussion of research method and design is in Chapter 3.

Definitions

Following are the definitions of terms relevant to the execution of this study:

Big data: the generation and usage of volumes of structured and unstructured data, which range in size from terabytes to petabytes (George, Haas, & Pentland, 2014).

Cloud computing: a pay-as-go service, which allows consumers the ability to connect to shared computing hardware, software, and services in any amount, arrangement, or for as long as they need (Nielsen, 2012).

Competitive advantage: the unusually tangible and intangible resources an organization has, which gives them unique advantages over similar firms (Dyché, 2015) or the ability to catch up to a competitor quickly (Turban et al., 2013).

Crowdsourcing: outsourcing the problem to collect data about the problem from scores of people (Estellés-Arolas & González-Ladrón-de-Guevara, 2012).

First Responder: a public safety official (e.g., police officers, firefighter, a member of a rescue squad, or other official personnel capable of performing life support) (Hansen et al., 2015).

Infrastructure-as-a-service: the on-demand access to servers, computers, storage, and networking equipment over the Internet for the client to install their software and applications (Yamato, 2015).

Major Disaster: an unpredictable natural or manmade disaster that is significant enough that the resources of a single emergency response agency are quickly overpowered (Scholl et al., 2012).

Platform-as-a-service (PaaS): an on-demand platform service to host software application for the consumer. PaaS is the delivery of computing platforms or a tailorable software package delivered over the Internet to a particular group of users (Dinesha & Agrawal, 2013).

Sociotechnical system: a complex system composed of technical and social subsystems, which influence one-another and the overarching system (Kroes, 2015).

Software-as-a-service: a business model that allows the customer to access and operate software from a service provider (Goode, Lin, Tsai, & Jiang, 2015).

Social media: consist of the hardware, software, and applications, which connect social networks (Chai & Kim, 2012).

Ushahidi: a service developed during the violence in Kenya in 2008 to crowdsource, aggregate, and map crisis information from multiple sources (e.g., social media, text messages, emails, radio, and television) (Fraustino, Liu, & Jin, 2012).

Assumptions

The first assumption of this study was the participants would be honest and open about their knowledge and experience regarding alignment between SMAC technologies and disaster response. The participants in this study might not be able to share their tactics, techniques, and procedures in public for security reasons. In addition, the participants may be bound for legal reasons not to share incidents of failure or negative information about their organizations. The document review and the semistructured interview questions were critical to the ICT managers answering the research questions on aligning SMAC technologies with disaster response.

The second assumption was the participants chosen for this study would have the appropriate training and experience. I selected participants from a purposive sample of ICT managers from a disaster response agency in the state of Hawaii. The selection criteria for the participants in this study included that the ICT managers be full-time employees of a state level first response agency within the state of Hawaii. In addition, the ICT managers must have participated in a statewide disaster management exercise during the annual tsunami season (Cabucu, 2015). The state of Hawaii hosts an annual exercise that combines virtually every first response agency within the island chain to test their ability to collaborate during an emergency (Cabucu, 2015). This assumption was

necessary because ICT managers involved in the exercises or simulations may have observations and experiences from the annual exercises, which shaped their understanding of ICT used by first response agencies and the influence of ICT on disaster response strategies.

The third assumption was the ICT managers who participated in this study would possess some level of knowledge and experience on SMAC technologies. This assumption was necessary because SMAC technologies are nearly ubiquitous in some form (Shelton, 2013). It was unnecessary that the participants in this study used SMAC technologies in their personal or professional environment, but at least they should have had an awareness of current trends in ICT.

Methodological Assumptions

The first methodological assumption was the research design selected for this study was the correct method to answer the research questions. I used the grounded theory research design from Glaser and Strauss (1967) to explore what disaster agency ICT managers' thought about SMAC technologies and disaster response. A grounded theory approach allows the development of a theory based on the collection of data rather than data being dependent upon how the theory is generated (Glaser & Strauss, 1967). This assumption was necessary as the literature review revealed a gap in level of understanding of aligning SMAC technologies with disaster response with ICT managers from the United States.

The second methodological assumption was the conceptual framework selected for this study was correct. Interoperability spans across technical and social dimensions. Decision makers and first responders from disaster response agency depend on the ability

and the technical means to interoperate between agencies (Vassiliou & Alberts, 2013). The level of interoperability between first response agencies is also dependent on the willingness of decision makers and first responders to share information with external agencies (Vassiliou & Alberts, 2013).

The power of SMAC technologies is more than a new arrangement of hardware and software but is also realized through the cultural shifts in people and society (Dyché, 2015; Shelton, 2013). Increases in computing power in congruence with the reduction in the cost of ICT hardware has been revolutionary for changing communication patterns of people. Users of social media can communicate with millions of individuals across the globe instantly. For example, social media was credited as creating a movement during recent events such as the Arab Spring in 2010 by mobilizing people and distributing information faster than traditional means such as television (Wolfsfeld, Segev, & Sheafer, 2013). Another implication is that now businesses organize their emloyees around networks of individuals rather than organizational charts (Shelton, 2013).

SMAC technologies have redefined how businesses, the public, and society as a whole view information systems. The changes SMAC technologies have made on the outcomes of natural disasters mainly sharing information is an example of the power of SMAC technologies. During the 2010 earthquake in Haiti, the disaster victims enabled by SMAC technologies exceeded expectations (Sarcevic et al., 2012). The disaster victims were able to organize, share information, and report their conditions faster and with more people than official first responders. However, the official first responders continued using existing ICT and disaster response strategies with similar results as previous major disasters.

Understanding the lack of interoperability in the context of major disasters and SMAC technologies is a complex issue. The lack of a theory or an incorrect framework would leave researchers without a structure to dissect the problem correctly (Kaehne, Ridley, & Kiernan, 2016). If the problem is not understood properly, then the chance of practical solution is diminished, and the outcome is the problem persists. For example, the literature review showed that some of assumptions made about interoperability failure (Laakso and Palomäki 2013, Vassiliou & Alberts, 2013), and SMAC technologies (Bressler et al., 2012; Laskey, 2013; San Su et al., 2013) were made without actual evidence. Moreover, practitioners and researchers made assumptions about solutions to the lack of interoperability using SMAC technologies only to have them ultimately rejected by decision makers and end-users (San Su et al., 2013; Sarcevic et al., 2012). Therefore, the incorrect selection of a conceptual framework would be consequential, as the underlying basis for the study could faulty.

Scope and Delimitations

The scope of this study was limited to the exploration of strategic alignment within disaster response agencies within the state of Hawaii. The specific focus of this study was to explore disaster agency ICT manager's level of understanding about alignment between SMAC technologies and disaster response. The findings from this study may not transfer to disaster response agencies in other states or at another level within the U.S. government or internationally.

The execution of a disaster response strategy is inextricably dependent in ICT. Therefore, SMAC technologies may cause significant changes in disaster response strategies similar to the changes in the commercial industry (Dyché, 2015; Shelton,

2013). Billions of dollars have been spent in the United States alone to ensure first responders' ICT is interoperable in the case of a major emergency (Moore 2016; Peha, 2013). At data collection, the literature was scant, which incorporated the point of view of ICT managers. At the time of data collection, the Department of Homeland Security was preparing to invest the largest amount ever in a total overhaul of first responders ICT (Goldstein, 2012; Moore, 2016; Peha, 2013). The ramifications are that numerous technical, social, and financial challenges exist to completing the project. Exploring how what ICT managers understand about alignment between SMAC technologies and disaster response offered potential new insights, and led to a framework which may be used to generate a future theory.

Two delimitations occurred in this study. First, the use of grounded theory relied on participants who demonstrated a limited understanding of alignment between SMAC technologies and disaster response. The second delimitation of this study was I did not include disaster agency ICT managers from the federal government or active duty Department of Defense (DOD) disaster response agencies because their ICT is proprietary (Wise, 2009).

The diffusion of SMAC technologies may have a similar influence on decision makers from disaster response agencies, first responders, and the operation of ICT of disaster response agencies, which range from local organizations, to federal government agencies and the DoD. Moreover, based on the literature review, the same agencies may become involved with a disaster response agency from a state depending on the type or scale of the catastrophe. I focused on states because the billions in funding for ICT infrastructure to improve interoperability funnels through state coordinators (Goldstein,

2012). Therefore, the possibility exists that the application of similar methodologies from this study could be transferable to other studies. Hence, the research methodology, design, and potential findings could be useful for future studies of local, federal response agencies, and DoD disaster response agencies.

Limitations

Three limitations occurred in this study. The first limitation could have been a methodological limitation. I used a qualitative grounded theory approach to answer the research questions. The grounded theory approach allows for the development of a theory where little data were available prior (Glaser & Strauss, 1967). Hence, data gained in this study may not transfer to disaster response agencies in the 48 continental states, Alaska, and United States territories because I explored ICT managers from disaster response agencies in the state of Hawaii. Additional research into ICT managers from agencies in other states or international agencies may be required to overcome this limitation.

The unique geography and natural disaster threats to the state of Hawaii may limit the generalizability of this study. In the aftermath of a natural or human-made disaster on one or more of the island masses, which make up the state of Hawaii, interagency cooperation from other states would be delayed because of distance (Federal Emergency Management Agency, 2014e). The response could be delayed even further as the state of Hawaii consists of eight islands of which seven are inhabited (NETSTATE, 2016). Disaster responders from the state of Hawaii have unique geography challenges which form jurisdictions. No other state in the United States has these features; however, the state of Hawaii is funded and managed under the same disaster management frameworks as are the other 49 states (Federal Emergency Management Agency, 2014e).

The disaster event of most significance to the state of Hawaii is the tsunami (Wise, 2009). Tsunami is a massive wave of water created by an earthquake event (Mori & Takahashi, 2012), hence, the threat of a tsunami may only be relevant to states with substantial coastal areas. The major disasters of significant consequence may be different for other states and territories. Regardless of the type of disaster response agency or location, tsunamis are caused by an earthquake event, and tsunamis cause massive flooding (Mori & Takahashi, 2012). Tsunamis may be a unique type of natural disaster for the state of Hawaii, and other coastal states, the global definition of a major disaster is still a proper definition.

I could have generalized the results of this study to overcome this limitation. No boundaries exist by location, type of first response agency, or industry in aligning ICT with strategy. The results of this study may serve as a framework for the further exploration of managing the problem or as input into developing a future theory. Disaster response agencies in the state of Hawaii may have some unique geographical and disaster response characteristics, but the lack of interoperability is a common problem for all disaster response agencies across the United States (Moore, 2016). In addition, aligning advances in ICT with disaster response strategies is a global issue (Bressler et al., 2012; San Su et al., 2013; Vogt, 2012).

A second limitation of this study was finding a sample of disaster agency ICT managers who had the necessary experience to meet criteria for this study. One of the criteria for participant selection was that the sample of ICT managers should have participated in an annual disaster response exercise in the state of Hawaii (Cabucu, 2015). The addition of this criterion was necessary for the completion of this study because it

was not likely the ICT managers would have real-world experience as an ICT manager during a disaster. Thus, experience in a training exercise would serve as a realistic simulation contributing to disaster agency ICT managers' experiences about interoperability between agencies and disaster response strategy. To overcome this limitation, I used a convenience snowballing technique to find additional participants.

I used a small, purposive sample of ICT managers from multiple disaster response agencies. I used semistructured interviewing techniques to recruit a sample of nine ICT managers from emergency response organizations within the state of Hawaii. The study did not include disaster agency ICT managers at the local, federal, or DOD level. In addition, I did not include disaster agency ICT managers from international disaster response agencies. However, at the time of data collection, a gap in the literature existed regarding the present issue of the lack of interoperability between disaster agencies in the United States. Instead I focused on an alignment between SMAC technologies and disaster response from the perspective of the ICT manager.

A third limitation may have influenced the credibility and dependability of the study (R. Yin, 2013). I used an interview questionnaire developed by me to conduct the interviews. However, my personal and professional bias did not influence the collection of the data and analysis. To reduce the lack of credibility, transferability, dependability, and confirmability as a limitation, I took specific steps in the design of the study to increase the trustworthiness of the data (R. Yin, 2013). Before using the interview questionnaire, I used the Delphi technique to gain consensus from a panel of experts to provide expert feedback on the interview protocol, interview questions, and the document review matrix. After conducting each interview, I used member checking to ensure that

data collected from the participants were the same as stated by the participants (Patton, 2015). After transcribing the interviews, I provided the participants with a copy of the transcripts to give them an opportunity to verify data were correct (Patton, 2015). A more in-depth discussion of the steps taken to avoid bias is in Chapter 3.

Significance of the Study

Significance to Practice

I used a management concept to address a longstanding problem in the field of disaster management. Specifically, I used the concept of alignment between ICT business to explore the challenges providing ICT, which is interoperable between disaster response agencies. At the time of data collection, research into the value of ICT initiatives designed to improve interoperability was nearly nonexistent in the United States and did not address aligning SMAC technologies with disaster response to improve the value of ICT investments. The ineffectiveness of ICT initiatives hinders the ability of disaster response organizations to interoperate during major disasters, which weakens the recovery of the populations affected by the disaster (Goldstein, 2012; Moore, 2016; Peha, 2013). ICT initiatives have left disaster response agencies vulnerable to interoperability failures during major disasters because ICT initiatives have become unaffordable and technologically inferior. Furthermore, the limitations exist because ICT initiatives support unrealistic disaster response strategies (Kruke & Olsen, 2012; Ley et al., 2012; Oh, 2012).

Conducting this study could mitigate the technological, social, and financial issues associated with ICT initiatives and disaster response strategies. The new framework could provide researchers and practitioners with a common ground on the

issues as a starting point to developing practical applications. For example, SMAC technologies could accelerate the completion of interoperability improvement initiatives sponsored by the Department of Homeland Security. The risks associated with interoperability improvement initiatives possibly will be shifted from the current narrow band of suppliers (Peha, 2013). Implementing commercial-off-the-shelf SMAC technologies using open standards could lower hardware costs because of increased competition.

Components of SMAC technologies such as analytics could become easier for disaster response organization to train on and trust if assisted by experts in analytics. Researchers and practitioners could work together to build training programs on SMAC technologies. Building on the training programs, a team of ICT managers and outside experts could increase trust in data by changing how decision makers and first responders consume and visualize information. Inprovements in training and trust might manifest into faster decision making by decision makers and reduced burdens on first responders (Gorcin, 2014).

Significance to Theory

SMAC technologies are the fastest leap in ICT since the invention of the Internet (Shelton, 2013). SMAC technologies could increase efficiency of disaster response by increasing the level of collaboration and coordination between disaster agency decision makers, first responders, and experts (Zlateva, Hirokawa, & Velev, 2013). One implication of the influence of SMAC technologies is public organizations will need form a new way of thinking about aligning ICT and strategy (Dyché, 2015; Shelton, 2013).

The outcome of conducting this study resulted in a framework that could provide input in a future theory on alignment between SMAC technologies and disaster response.

The findings from this study arranged into framework suggest that ICT managers from disaster response agencies in the state of Hawaii understood aligning SMAC technologies and disaster response strategy. The findings from this study indicate that SMAC technologies and legacy technologies already coexist within disaster response organizations. First responders in the state of Hawaii, presently depend on ICT from the 1970s, but decision makers made use of components of SMAC technologies. The framework shows that there are challenges with leveraging SMAC technologies. The framework shows the proposed solutions offered by the ICT managers interviewed in this study. The data collected from disaster victims using social media is still not trusted. Experts in SMAC technologies working as a team with ICT managers, volunteers, and disaster victims would be necessary to make SMAC technologies useful.

The new framework could result in new perspectives on how to reduces the gaps alignment between ICT and strategy. Disaster response organizations currently develop, and acquire ICT to support their disaster response strategies. However, SMAC technologies has driven changes in commercial business attitudes about ICT. Commercial businesses are changing their strategy incongruence with SMAC technologies (Dyché, 2015; Shelton, 2013). The findings from this study might prompt disaster managers to consider eliminating inflexible disaster response strategies supported by outmoded ICT for disaster response strategies that are governed by data, not hardware. Moreover, the results of this study may prompt additional research within the field of management applicable to similar organizations, problems, and advances in ICT.

Significance to Positive Social Change

The results of this study are significant to positive social change because this study led to the creation of a framework, which could improve alignment between SMAC technologies and disaster response strategies in the United States. The results of this framework study may result in new strategies, which lead to increased levels of interoperability between disaster response agencies and disaster victims during a major crisis. The result might be reduced injuries and deaths because first responders can respond faster.

The literature review revealed that one reason that first responders experience interoperability failure is because their ICT cannot keep pace. Distinctive first responders from multiple agencies responding to an incident as a team could move faster if they could coordinate with disaster victims impacted by the incident. Disaster victims using SMAC technologies could provide a picture of the incident. Visual or other data from the incident could prompt decision makers and first responders to coordinate with other agencies and move resources based on data versus instinct reducing duplication of effort. Positive social changes may be realized by first responders and decision makers changing their mindset toward SMAC technologies and building relationships with the communities they serve.

Without a framework, which melds legacy technologies with new technologies and people, disaster management organizations in the United States may continue to face the threat of interoperability failures during major disasters. In addition, multi-billion-dollar ICT initiatives including FirstNet might not become financially or technically viable in the near future.

Summary and Transition

In summary, the goal of this qualitative grounded theory study was to make a scholarly contribution to the study of management and promote positive social change. The completion of this study contributed to the disaster management field by applying management concepts to explore ICT managers' understanding of aligning SMAC technologies with disaster response. The findings from this study contributed to positive social change by increasing the value of ICT investments, by reducing the impact on affected populations during the major crisis, and by reducing the gaps in knowledge between first response organizations and the communities they serve. In Chapter 1, I addressed disparities in the literature on the alignment between SMAC technologies and disaster response. SMAC technologies could aid first responders' ability to interoperate between agencies and across jurisdictions during a major crisis (Rezaei, Chiew, & Lee, 2014). Therefore, all members of first response organizations must have a shared understanding of how SMAC technologies align with disaster response strategies. Understanding by all members is necessary so they can cope with the significant shifts in strategy caused by SMAC technologies (Shelton, 2013).

Chapter 1 included an introduction to the problem of disaster agency ICT managers' understanding of alignment between SMAC technologies and disaster response. In addition, Chapter 1 included the background, problem statement, purpose statement, research questions, nature of the study, scope, assumptions, limitations, delimitations, and significance. In Chapter 2, I present a review of the current literature, which compares, contrasts, and synthesizes the relevant literature on disaster response, SMAC technologies, and strategic alignment. Chapter 3 covers the research method,

research design, rationale, role of the researcher, methodology, and ethical procedures. In Chapter 4, I present the Delphi study, the research setting and the demographics, the data collection procedures, data analysis procedures, and the study findings. In Chapter 5, I conclude the study by interpreting the findings, limitations, recommendations, implications, and conclusions.

Chapter 2: Literature Review

In the United States, correcting and improving the level of interoperability between disaster response organizations is a costly problem (Goldstein, 2012; Moore 2012; Peha, 2013). The purpose of this qualitative grounded theory study was to explore emergency response ICT managers' understanding of how SMAC technologies are related to and can inform disaster response strategies. Although a large body of research exists on ICT and strategic alignment at the time of data collection, the research was nonexistent on the alignment between ICT and strategy in public organizations. Specifically, no current research existed on aligning SMAC technologies with disaster response strategies.

An examination of the literature provided an in-depth overview of SMAC technologies. This chapter highlights how SMAC technologies have led to significant strategic and hierarchal changes for organizations (Dyché, 2015; Shelton, 2013; Turban et al., 2013). Research indicates that the application of SMAC technologies within public organizations such as disaster response organizations effect member's perceptions of ICT (Laakso & Palomäki, 2013; Laskey, 2013; San Su et al., 2013; Vogt et al., 2011). Most members of disaster response agencies thought SMAC technologies created advantages when sharing information over existing ICT during major disasters. In addition, this chapter reveals the recent history of the application of SMAC technologies during major disasters and the value of using SMAC technologies to collaborate during major disasters (Dugdale, Van de Walle, & Koeppinghoff, 2012; Sarcevic et al., 2012; San Su et al., 2013).

The literature review for this study also uncovered a goal of alignment between ICT and business strategy, which is gaining and sustaining competitive advantages on the competition (Turban et al., 2013). The alignment was not an end-state but a never-ending balancing act between technical, social, and organizational factors (Gerow, Thatcher, & Grover, 2014; Luftman, 2004; Turban et al., 2013; Wu et al., 2014). However, at the time of data collection, research that explored aligning SMAC technologies with disaster response strategies appeared to be nonexistent. Specifically, there did not appear to be management research that explored the problem of interoperability failure between disaster response organizations.

At the time of data collection, the DHS in collaboration with the individual states were planning to build a single ICT network for disaster response organizations in the United States (Goldstein, 2012; Moore, 2016; Peha, 2013). The cost for this ICT initiative is between $13 billion to $45 billion. Despite the need, there is a high amount of uncertainty associated with this project because it will provide no new capabilities for first responders and is financially unsustainable (Goldstein, 2012, Moore, 2016, Hallahan & Peha, 2013). SMAC technologies have demonstrated the potential as well as the need for new strategic direction by organizations, which included public bodies, such as disaster response organizations (Vogt et al., 2011). Therefore, additional research is needed to add to the discussion.

Chapter 2 begins with an introduction to the problem, literature search strategy, and summary of the conceptual framework. The second section of this chapter is a literature review of key concepts. The next section is a literature review related to the

research questions. The next section is a description of the gaps in the literature. The last section is the summary and conclusions.

This chapter also includes a review of the history of the lack of interoperability between disaster response agencies in the United States and globally and how disaster management is changing. The literature review includes a discussion of the technology and human-centered problems, which cause disaster responders' inability to share time-sensitive information between agencies and across jurisdictions (Vassiliou & Alberts, 2013). It also examines the challenges organizational policies and strategies pose for disaster agencies who need reliable ICT to coordinate their actions with other agencies during a major crisis (Ducq et al., 2012).

Literature Search Strategy

The resources for this literature review came from peer-reviewed and academic resources. The online resources I used for this study were the Thoreau database, ABI/INFORM, Academic Source Premier, Business Source Premier, Education Resources Information Center (ERIC), Emerald Management Journals, Encyclopedias from Sage, Institute of Electrical and Electronics Engineers (IEEE) Xplore Digital Library, Military and Government Collection, ProQuest Central, and Science Direct. Publicly available online resources used were Google Scholar and Microsoft Academic. Manual resources I accessed for this study originated from local university libraries, public libraries, local bookstores, and from colleagues. Online publishers provided the online academic textbooks. The following words and phrases searched included, but were not limited to, *analytics, big data, cloud computing, crowdsourcing, disaster, disaster management, disaster response, first response, first responder, information sharing,*

information technology, Haiti earthquake, Hurricane Katrina, interoperability, interoperability failure, Mobile, September 11, 2001, social media, SMAC technologies, strategic alignment, and *terrorism.*

Conceptual Framework

Trist and Bamforth's sociotechnical theory served as the conceptual framework to ground this study. In addition, sociotechnical theory served as a lens to understand how ICT managers viewed aligning SMAC technologies with disaster response. Different interpretations of sociotechnical systems exist. To some, a sociotechnical system is a system consisting of people, knowledge, physical equipment, communication tools, and various interconnecting systems (Lu et al., 2011). The people associated with the system and the conditions the systems work under are considered one (Kim et al., 2012). Similarly, a sociotechnical system is a system comprised of actual physical systems and groups of individuals (Kurapati et al., 2012). The people within the sociotechnical system sustain the system. However, as the system grows, the number of people grow, which can lead to clashes in perspectives and reduced decision making (Kurapati et al., 2012). Finally, Ciborra (1999) demonstrated sociotechnical system approaches shifts the attention toward recognizing the effects of actions on a system such as an improvisation by the users.

Balancing hardware and people to maintain interoperability between first response agencies is sociotechnical in nature. At the time of data collection, the literature review revealed that the technical failures, which lead to interoperability failures, were not the only types of interoperability failures. Comfort et al. (2012) argued that disaster response organizations need to explore sociotechnical systems, such as social media, as a

platform to increase information sharing and decision making. Interoperability improvement initiatives mandate that the ICT first response organizations' use to interoperate during major disasters (Drouglazet et al., 2014; Fedorowicz et al., 2014). In addition, disaster management frameworks mandate which agency is in charge when multiple first response agencies need to respond.

SMAC technologies could be defined is the merging of powerful, low cost technologies operated with huge numbers of people and organizations to be more mobile and communicate more. SMAC technologies create distinctive advantages for one organization over another because of the noticeable effects created by the technology and the users (Dewan & Jena, 2014). The rationale is that SMAC technologies began with groundbreaking changes in ICT equipment and software. Innovations in ICT hardware and software made powerful ICT usually reserved for commercial enterprises, educational institutions, and government easily available to average citizens (Nielsen, 2012). The ability to emulate hardware using software multiplied the amount of hardware available to users gave rise to analytics (Dziuban, Moskal, Cavanagh, & Watts, 2012). Similar to having access to massive amounts of computing power and creating information is the ability to connect to and use this information on mobile devices (Dewan & Jen, 2014). Finally, social media is the software, which operates on top of ICT hardware and software, analytical systems, and mobile devices and serves as the methods of connecting people and data (Chai & Kim, 2012).

Although the SMAC technologies leverage the unique combination of ICT hardware and people, SMAC technologies could be considered a new way of doing things ((Browning, 2014). One factor is that the cost of communication for hundreds of

millions of people per day costs nearly zero (Shelton, 2013). Mobile devices give organizations and individuals the ability to communicate as they desire, communicate over multiple channels, and complete their usual computing tasks independent of location (Raman, 2015). The implications of cloud computing, mobile, and social media in part created a new product (Dyché, 2015). Data generated by social media and mobile devices can be processed using cloud computing to provide answers faster and with more accuracy than ever thought possible (Raman, 2015). The last factor is the innovation in hardware and software is ICT strategies. Business and creative individuals can buy access to SMAC technologies from experts rather than owning and managing the ICT themselves (Shelton, 2013).

Disaster response organizations do not care about competitive advantages created by ICT, but the success of disaster response depends on how agile the first responder and his or her ICT can be. Interoperability failure is partially a technical problem (Drouglazet et al., 2014). Oh (2012) argued, that during Hurricane Katrina, disaster management frameworks were ineffective because the ICT infrastructure that disaster response leaders and practitioners depended on collapsed. However, lack of ICT is only part of the story. Members of first response organizations could not interoperate because of behaviors by decision makers and first responders impeding effective collaboration via ICT. Thus, ICT that is not in alignment with disaster response strategy contributes to interoperability failure because of ICT and human problems.

SMAC technologies could improve the speed and effectiveness of disaster response decision makers and first responders by standardizing their hardware across organizations (Drouglazet et al., 2014). However, the findings from studies showed that

decision makers and first responders would need external assistance with SMAC technologies (Sarcevic et al., 2012). In addition, policy makers and first responders do consider the technology or the users a reliable source of information (Bressler et al., 2012).

In the context of this study, the sociotechnical perspective combines the technical and human component involving the alignment between SMAC technologies and disaster response. SMAC technologies will be a significant part of future catastrophes (Abbasi et al., 2012; Bressler et al., 2012). However, an exploration of ICT managers' understanding of alignment between SMAC technologies and disaster response is missing. A sociotechnical perspective assisted in answering the research questions by providing additional details in describing ICT managers' understanding of alignment between SMAC technologies and disaster response.

The literature on strategic alignment showed that gaining and sustaining competitive advantages using ICT is predicated on a relationship between technology and people (Chan & Reich, 2007; Howson & Hammond 2014; Reich & Benbasat, 2000). For example, business leaders can form a strategy, and ICT leaders furnish ICT to support the execution of the strategy. However, aligning ICT and business strategy is challenging if leaders from the business functional areas and leaders from the ICT department do not understand what alignment means or do not communicate nor seek to understand one another needs (Turban et al., 2013; Wu et al., 2014). Thus, the sociotechnical theory served as the conceptual framework to ground the study and served as a lens through which to explore disaster agency ICT manager's current level of understanding of alignment between SMAC technologies and disaster response.

Literature Review

This section of the study describes the literature review process. The literature review is a thorough survey of the concepts of the study and highlights the gaps in previous research (Menter & Hume, 2012), as well as precedes and guides the selection of a research topic (Poojary & Bagadia, 2014). My literature review includes peer-reviewed journal articles, influential and relevant books, government reports, and web pages to provide a broad and in-depth background on the research, which existed at the time of data collection on this topic.

I present the findings of the literature review conducted in the areas of disaster response, interoperability, SMAC technologies, and strategic alignment. I explored the literature available at the time of data collection on the existing problem of interoperability between first response agencies. The literature review revealed components of SMAC technologies as a potential solution to the problem. The rationale for this answer was because recent case studies and simulations suggested an avenue for additional research. Finally, while exploring the literature, I found gaps in the body of knowledge within the field of management. Specifically, the research on how the lack of alignment between ICT and disaster response strategies from the perspective of the ICT manager. SMAC technologies impact on the first responder's ability to interoperate during on society in the aftermath of a major catastrophe was minimal. At the time of data collection in this study, the research was minimal, which addressed the lack of interoperability between disaster response agencies as management problem given the scale and cost of ICT involving the problem.

Disaster Definitions

No single definition of a disaster existed at the time of data collection. The descriptions of a catastrophe are similar to the impact they cause on society globally. In the United States, the Federal Emergency Management Agency (FEMA) defined a disaster as a natural or technological event that causes death or injuries to the citizenry, disrupts operations, causes physical or environmental damage, or threatens society's financial standing (FEMA, 2017). The United Nations defined human-made or natural disasters as a serious disruption of the functioning of a community or a society involving widespread human, material, economic, or environmental losses and impacts (United Nations Office for Disaster Risk Reduction, 2007). The United Kingdom's first response agencies defined a major incident as an event that requires more than one emergency service to manage the incident such as a chemical, biological, radiological, or nuclear incident (Cabinet Office, 2012).

The threat of a natural or human-made disaster is an ever-present problem that is growing in occurrence and level of devastation (Comfort et al., 2012). In the United States and globally, the loss of life and property from natural and human-made disasters and terrorism are on the rise. For example, in the United States, the devastation will affect more citizens because the population of people in hazardous areas (e.g., technical complexity and interdependence of critical systems and illegal actions) is increasing (Comfort et al., 2012). However, according to Whybark (2015), future disasters will not result in as many deaths as in the past, but will adversely affect greater populations of people than in the past.

Disaster Response

In the United States, the initial responsibility for disaster response begins at the lowest level (FEMA, 2013; The Stafford Act, 2013). When a disaster happens in the United States, under federal law, the individual states are in charge of responding to a disaster unless they ask for assistance from the federal government, or unless directed by the president of the United States (FEMA, 2013). The Sandy Recovery Improvement Act of 2013 provided the authority for disaster responders from the federal level down to the local level to provide an integrated and comprehensive response to natural and human-made disasters. The Sandy Recovery Improvement Act gave the president of the United States the authority to declare an emergency and then provide resources to the affected states to mitigate the effects of a disaster. A key element of this act is it gives states a standardized approach to preparing for and maintaining an efficient response capability. The states are in charge of the execution of the disaster response effort, but they must follow guidelines set by the Department of Homeland Security to stay prepared and systematically respond to incidents in the aftermath of the disaster (Jenson & Waugh, 2014).

Disaster Management Frameworks

Brattberg (2012) argued that a disaster response must be ready for and executed according to defined plans. The United States government manages the deployment of disaster response resources using disaster management frameworks and incident response systems. The Department of Homeland Security mandates standardized incident management protocols and procedures to manage the activities of first response agencies. For example, the National Incident Management System (NIMS) is a template (Brattberg,

2012) that provides a systematic and proactive guide to public and private organizations during the execution phase of a major catastrophe (FEMA, 2014b).

The use of the Incident Command System (ICS) at the scene of all disaster response incidents is also mandatory (Jensen & Waugh, 2014). The Incident Command System is a standardized approach that integrates the functional areas of the response effort (Jensen & Waugh, 2014). The goal of ICT is to enable first response organizations directly involved in a specific event (e.g., active shooter, terrorist bombing, or forest fire) from multiple jurisdictions to combine their resources (Ryan, 2013). In other words, ICS is a temporary organization built from multiple first response organizations operating under with clearly defined lines of leadership (Jensen & Waugh, 2014). Research indicates ICS was popular across first response organizations (Jensen & Waugh, 2014); however, doubts existed about the effectiveness of the ICS because the employment of ICS is incorrect at incidents. For example, in a study by Jensen and Waugh, the use of ICS was primarily at the same type of small-scale events, and the ICS was less effective amid disasters that did not fit into the ICS structure.

Interoperability

The 9/11 Commission defined interoperability as the ability of EMS, fire, police, and public health officials to communicate with each other while responding to an emergency (Kean & Hamilton, 2004). The Department of Homeland Security defined interoperability as the ability of emergency responders to work with other systems or products without any special effort (Federal Emergency Management Agency, 2016). The Department of Defense definition of interoperability is the ability to operate in synergy in the execution of assigned tasks (Department of Defense Dictionary of Military

and Associated Terms, 2010). The definitions of interoperability encompass the first responders' ability to communicate with one another, understand one another, and work together while responding to a complex crisis.

Interoperable ICT is the central element in being able to make decisions and to exchange information. First response organizations depend on ICT that is compatible between agencies. According to Ley et al. (2012), first response organizations depend on ICT that is technically compatible between agencies to synchronize the actions of multiple first response organizations during the response. ICT that is interoperable between first response agencies is important because the lack of interoperability can cost saving lives and prolong the adverse effects of major disasters (Doumi et al., 2013).

A high probability exists that the impact of a disaster event will exceed the resources of a single disaster response agency (Cabinet Office, 2012; Scholl et al., 2012). A major disaster is often unpredictable (Scholl et al., 2012). Consequently, the number of participants will grow in step with the growth in magnitude and adverse outcomes of the disaster (Palttala et al., 2012). Hence, disaster response agencies will need to be able to make decisions and share information across multiple agencies (Scholl et al., 2012).

Interoperability Failure

Interoperability failure is one of the leading problems for first response organizations (Drouglazet et al., 2014). Interoperability failures between first response organizations during the 9/11 attacks and Hurricane Katrina focused renewed the attention on interoperability failure (Feeney, 2012). In a Delphi study of 35 Finnish first response agencies by Laakso and Palomäki (2013), the issue with the highest occurrence was the lack of interoperability between two first response organizations' ICT systems.

According to Drouglazet et al.'s (2014) research findings, a pattern of interoperability failure persists for numerous reasons. The first reason is for technological reasons. Each first response agency operates on its set of radio frequencies (Comfort et al., 2012). The cause is incompatible radios because of the unequal distribution of frequencies between disaster response agencies (Rezaei, Chiew, & Lee, 2013). As a result, while responding to a disaster, interagency first responders cannot share information with other types of first response agencies or across geographical jurisdictions (Wise, 2009).

Interoperability Improvement Initiatives

Overcoming the unequal distribution of frequencies requires a large-scale effort (U.S. Department of Homeland Security, 2014a). More than 74,000 first response agencies need to interoperate during a major crisis (Gorcin, 2014). The approach to improving interoperability between first response organizations at the state and local level is through ICT initiatives led by the Department of Homeland Security (Department of Homeland Security, 2014a).

The first type of ICT initiative designed to improve interoperability after the tragic interoperability failures during 9/11, terror attacks was the SAFECOM program. The goal of the SAFECOM program is to overcome the disjointed distribution of radio frequency spectrum by providing research and development, oversight, training, and technical expertise to state and local first response agencies (Drouglazet et al., 2014).

Project 25 was a follow up ICT initiative to the SAFECOM program to overcome the technical shortcomings of the SAFECOM program. Project 25 (P25) program provides a set of technical standards a variety of vendors could meet (Drouglazet et al.,

2014). By increasing competition between suppliers, state and local first response agencies could choose from a variety of radios that would comply with a range of technical standards (Drouglazet et al., 2014). In the event of a disaster, first response organizations with handsets that met the P25 standard would be compatible with the handsets from a variety of first response agencies.

The current ICT initiative will replace the entire network in use by first responders. FirstNet is a single telecommunications network for all first responders nationwide (Moore, 2016; Peha, 2013). FirstNet will increase data capability of first responders (Goldstein, 2012). Regardless of geography, first responders could reach back to their home agencies (Goldstein, 2012). In addition, they could share information with any other first response agency regardless of location and type of agency.

The legacy of the SAFECOM and P25 is they are expensive radios and ICT infrastructure that are still not fully interoperable between first response agencies (Goldstein, 2012). However, FirstNet will not provide a voice communications capability for first responders. FirstNet will serve as a backup until the creation of a solution for push-to-talk radio functionally. Moreover, the change is ICT infrastructure would limit the ability of first responders to communicate while inside a building or while disconnected from the network (Goldstein, 2012). The installation of additional ICT before an incident would be necessary.

A report to the United States Congress noted that the investment of $13 billion dollars between 2001 and 2012 significantly increased first responders' preparedness to interoperate during major disasters (Moore, 2016). Interoperability improvement initiatives began in 2001 and before the establishment of the 2012 FirstNet initiative have

not delivered the desired results in more than a decade of effort (Moore, 2016). They may not deliver any additional value with additional financial and time investments (Goldstein, 2012; Moore, 2016; Peha, 2013).

Testimony given to the United States Congress by the former chief of the public safety and homeland security bureau stated that the FirstNet project did not have enough funding, and the technology would be out of date by the completion of the first phase (Oversight of FirstNet and Emergency Communications, 2013). The expectation is that the FirstNet would cost between $15 million (Peha, 2013) and $45 billion and take 10 years to complete (Moore, 2016). Goldstein (2012) explained the means to pay for FirstNet was to lease the infrastructure to private industry until a disaster and then reclaim it temporarily during a disaster. As of 2012, only a handful of states had begun to construct a broadband network for their first response organizations (Goldstein, 2012).

Lack of Information Sharing

Another reason for interoperability failure is a failure to share information. According to Scholl et al. (2012), the effectiveness of the disaster response effort depends on the quality of the information. Scholl et al. found that information sharing was problematic because most of the information was not usable. Laakso and Palomäki (2013) found that the different terminology used by first responders from various first response agencies led to miscommunication and skewed reactions to information. Palttala et al. (2012) found that timeliness of the information was the cause of most of the information sharing problems.

Vassiliou and Alberts (2013) suggested that people and organizational factors affect first responders' unwillingness to interoperate more than the technical inability to interoperate. For example, first responders were unwilling to trust one another's information because first response organization most likely will not have met before (Palttala et al., 2012). In addition, communication breakdowns arose because no one knew who was in charge (Vassiliou & Alberts, 2013), or because of differences in the decision making process and management techniques (Ducq et al., 2012).

Complexity

A seldom considered reason for interoperability failure is the complexity of responding to the disaster. Kruke and Olsen (2012) showed that interoperability failures happen because major disasters are unpredictable and do not fit a predetermined plan. A first response organization's agility is dependent on the quality of its ICT. First response organizations quickly exceed their capacity to function when multiple ICT systems fail (Kruke & Olsen, 2012). Moreover, Scholl et al. (2012) argued that practice in the form of disaster response drills is better than relying on standard operating procedures. Thus, first responders' ICT must support the unpredictable needs of first responders rather than routine needs. (Ley et al., 2012).

Although, interoperability between first response agencies is not a problem for ad-hoc formations of first responders when disaster response events are low in complexity (Vassiliou & Alberts, 2013). Laakso and Palomäki (2013) found that leadership overlooked major disasters or complex catastrophes. First response organizations focused on training exercises that only consisted of small-scale activities with typical scenarios. Moreover, drills that required different agencies to interoperate were also not included.

SMAC Technologies and Disaster Response Actions

Social media, mobile, analytics, and cloud computing would play an increased role during future disasters. Social media could improve interoperability and information sharing capabilities across all first response agencies (Abel, Hauff, Houben, Tao, & Stronkman, 2012). For example, during a disaster, first response organizations could use social media that automatically organize Tweets. In addition, disaster response agencies can outsource tasks to external experts (Abel et al., 2012).

Similar to Abel et al. (2012), Rezaei et al. (2014) also claimed SMAC technologies could aid first responders' ability to interoperate between agencies and across jurisdictions during a major crisis. However, Hughes et al. (2012) argued the information gathered from social media usage by civilians was an additional stream of information, which is useful to decision makers. For example, Fernando, Loke, and Rahayu (2013) explained that during a disaster, Google maps of the affected area were useless. Staff from disaster response organizations can reassemble photos collected from the population to make an up-to-date map in real-time (Fernando et al., 2012).

Zlateva et al. (2013) study was unique in that it integrated ICT and disaster response practices. Zlateva et al. (2013) asserted social media, mobile, analytics, and cloud computing were not separate technologies but were a nesting of forces. For instance, cloud computing would enable first responders to respond via a virtual means to a disaster anywhere on the earth. Mobile computing enables rapid threat assessment. Social networks would allow disaster responders, relevant nongovernmental stakeholders, and disaster victims to converge more quickly using social media to connect faster and with more people. However, in the discussion section of Zlateva et al.'s study, the authors

preferred cloud as their SMAC technologies component of choice for disaster response. Cloud computing would be limited to usage by virtual teams to conduct risk assessments.

Components of SMAC Technologies

Chai and Kim (2012) quantitative study defined social media as the hardware, software, and applications that people use to connect social networks. For example, Twitter is a microblogging solution that uses unique tags to organize and distribute information (Bruns & Liang, 2012; Imran, Elbassuoni, Castillo, Diaz, & Meier, 2013). From a business perspective, social media allow for unfettered sharing of information to start conversations so organizations can receive feedback from participants on a social network (Dewan & Jena, 2014). According to Patel (2012), social media can provide information targeted to a specific group at a given moment.

Mobile is the technical ability and freedom to process information from any location on demand (Frank, Roehrig, & Pring, 2014). Mobile devices range from smartphones to smartwatches capable of non-typical tasks such as proving global positioning services (GPS) and sensing its environment (Frank et al., 2014). Mobile devices make the web mobile so that users can interact with organizations on some mobile device (i.e., phones, tablets, and laptops) (Dewan & Jena, 2014). For example, Raman (2015) explained in her mixed-methods study on nonprofits that in disadvantaged countries and populations, mobile devices could overcome the lack of transportation and access to everyday commodities (Raman, 2015).

Analytics is the next step in ICT necessary to process massive amounts of data and types of data from a variety of sources (Dziuban et al., 2012). Users of analytics are trying to make predictions based on massive amounts of data in as many forms as

possible (Dewan & Jena, 2014). Analytics can provide a visual description of the organization's current efficiency or problems at a moment's notice (Raman, 2015).

Cloud computing is a framework, which provides a shared pool of computing resources, and enables ubiquitous, convenient, and on-demand network access (Frank et al., 2014). Organizations can borrow computing resources and support when they need it and pay as they go, which is similar to how consumers pay for utilities (Dewan & Jena 2014). According to Nielsen (2012) and Garrison, Kim, and Wakefield (2012), cloud computing is a new arrangement of ICT that lowers the cost and expertise of ICT while increasing access and creativity. For example, Instagram was first run with a small group of employees using cloud computing and was bought for $1 billion dollars in less than two years from inception (Zhang, 2012).

SMAC Technologies and Major Disasters

Sarcevic et al. (2012) collected data during the search and rescue operations during the 2010 Haiti earthquake. Sarcevic et al. explored 110 emergency medical response teams and other types of first response organizations. The actions of the victims and volunteers during the 2010 Haiti earthquake showed that unofficial first responders could collaborate and coordinate their actions in simpler and quicker ways than could official first responders (Sarcevic et al., 2012). Disaster victims demonstrated to strengths of social media to collaborate during a major catastrophe. The ubiquitous distribution of social media empowered the disaster victims (Denis, Hughes, & Palen, 2012). Social media could enable faster coordination of first responders (Sarcevic et al., 2012). Sarcevic et al. (2012) found that first responders' Tweets were only broadcasts of their

conditions. The implications for first response organizations are the use of social media by volunteers is a foregone conclusion during future disasters (Denis et al. 2012).

J. Yin et al. (2012) participated in an Australian emergency response exercise that explored a whole of government's approach to disaster response. According to J. Yin et al. (2012), the primary means of first responders' communication with disaster victims was one-way via a variety of media outlets. J. Yin et al. (2012) argued that social media offered first responders the opportunity to enhance their situational awareness by incorporating data from disaster victims and people near the impacted area. J. Yin et al. (2012) recommended a system that leveraged the streams of Tweets from Twitter. J. Yin et al. (2012) considered Twitter because the concentration of Tweets corresponded with events affecting the population in real-time. Thus, Twitter could provide a sensor for detecting events and determining the impact of the event. Despite the potential of social media, information sharing between first responders and disaster victims has not changed first responders' perspective toward the exchange of information.

Respondents from the study conducted by Palttala et al. (2012) stated uniform decision making and coordination structures could improve communication among first response organizations. Palttala et al. (2012) found that first response organizations were unable to coordinate their communications with disaster victims, which led to several inconsistencies and confusion for disaster victims. Collaborating with communities affected by the catastrophe empowered the community by giving them a sense of control and well-being. However, the channels of communication must be in place before the disaster because they are competing with other lifesaving activities in the aftermath of the catastrophe (Palttala et al., 2012).

Social media empowers the affected population (Vihalemm, Kiisel, & Harro-Loit, 2012). For example, the affected population uses social media to crowdsource resources useful to the disaster from a vast network of connected individuals (Dufty, 2012). Equally important is to change the state of communication with official first responders. Sykes and Travis (2012) argued that social media have the potential to improve the communication processes from a one-way conversation to a collaborative process. Social media give voice to the populations affected by the catastrophe (Sykes & Travis, 2012).

Abbasi et al. (2012) reported on social media in a simulated disaster response exercise called the Arizona State University Response Game. Abbasi et al. (2012) created the game to provide a simulated environment for testing applications that processed Twitter and SMS feeds to collect requests for help from disaster victims. Abbasi et al. (2012) found that social media usage during a crisis has potential applications for first response organizations. Social media offer an alternate communication path. Social media could be instrumental in building situational awareness. In addition, the role players who pretended to be disaster victims expected social media to play a central role in disaster response. Abbasi et al. (2012) found that several problems existed in processing social media. First response agencies did not know how to capture and leverage unstructured data streams. The players were able to handle approximately 200 Tweets and 200 SMS in a 4-hour period. The problem is that people send 200 million Tweets a day (Abbasi et al., 2012).

Bressler et al. (2012) also found similar challenges, as did Abbasi et al. (2012). Bressler et al. (2012) conducted a large-scale test of the effectiveness of social media and crowdsourcing for organizing humanitarian assistance and disaster response by building

collaboration. Over 12,900 participants in the United States portion of the training were from federal agencies and the Department of Defense. The 49,000 members from the European part of the exercise were senior military leaders from 92 countries. Bressler et al. found that social media increased all measures that first responders needed to be effective during disasters including interoperability. Bressler et al. (2012) found that first response organizations lacked opportunities to test and exercise social media, lacked policy and funding, and suffered from a lack of adoption and understanding of the latest technologies. Most importantly, first responders argued that they could not take necessary steps solely based on Tweets and Facebook posts from the public because they believed the tweets and posts would not be accurate (Bressler et al., 2012).

San Su et al. (2013) conducted a survey of 500 public information officers from state, county, and local first response agencies from all 50 states. San Su et al. (2013) found that state and local first responders were only familiar with the many forms of social media. More than half of state response agencies used social media, and 90% of local first response agencies used social media. Commitment and buy-in from senior leadership were 100% higher at the state level than at the local level. However, first responders were willing users of social media, but they were regurgitating information and directing the affected population (San Su et al., 2013).

The findings from the same study found that first responders were not familiar with terms such as crowdsourcing or tools such as Ushahidi (San Su et al., 2013). San Su et al. (2013) argued that for first response organizations to be able to take advantage of data analytics, the first response agency would have to rely on external experts in analytics. However, at all levels within the state, on average, 50% of first responders

trusted social media less than they trusted traditional sources of media. First responders reported that they could not deploy based on social media without verification.

SMAC Technologies and Business Strategy

Users of SMAC technologies combine the strengths of social media, mobile, analytics, and cloud computing to make them more powerful together than they are separate (Shelton, 2013). SMAC technologies ignite creativity within businesses leading to competitive advantages by merging the strengths of social media, mobile, analytics, and cloud computing (Dewan & Jena, 2014). SMAC technologies are the fastest revolution in computing to date (Frank et al., 2014). The adoption by business organizations of social media is 34%, mobile is 4%, analytics is 54%, and cloud computing is 39% (Higgins & Clark, 2013). According to Dewan and Jena (2014), in a business context, social media bring business closer to their customers; increase internal communications channels, and feeds analytical systems the millions of personal insights from social networks.

Mobile devices increase the power of social media because the ability of the social media is to connect anytime and anywhere (Raman, 2015). Mobile can provide real-time access to customers and employees. In addition, mobile devices can digitize the enterprise reducing process time and steps (Dewan & Jen, 2014).

Crowdsourcing is a form of analytics that often depends on the millions of users linked by social media and mobile to analyze a problem (Estellés-Arolas & González-Ladrón-de-Guevara, 2012). The use of mobile and social media is creating an overabundance of data; thus, tools are needed to sort data into two models. Data can aid in predictions by feeding statistical analysis platforms to support decision making.

Otherwise, the model is prescriptive, which means it assists in helping existing business rules in real time (Dewan & Jena, 2014). The infrastructure supporting data on mobile devices and analytics is only possible with cloud computing (Gasser, Palfrey, & Becker, 2012; Howard, Plummer, Genovese, Mann, & Willis, 2012; Shelton, 2013). The benefit of cloud computing is that it removes barriers and may offer new capabilities (Dewan & Jena, 2014).

SMAC technologies create competitive advantages for businesses by reshaping their products and services (Shelton, 2013). No difference exists between business technology and consumer technology (Andriole, 2012). Heisterberg and Verma (2014) explained that those who leverage data in unique ways would realize competitive advantages. The huge amounts of data created by SMAC technologies are more valuable than is a physical product (Dyché, 2015; Turban et al., 2013). The majority of the information is coming from the user and the user's environment (Sherchan et al., 2012; Tene & Polonetsky, 2013) via social media (Shelton, 2013). Therefore, businesses are changing from focusing on their data to an emphasis on the individuals who are creating data (Danson & Griffin, 2012). Business leaders not only know how much their customers spend, but know why the customer purchased what they did, and what other purchases happened because of the first purchase (Frank et al., 2014).

Businesses can eliminate the overhead of managing ICT by using SMAC technologies (Dhar, 2012). The latest trend is to outsource some or all ICT operations to run a business (Dhar, 2012). SMAC technologies enable a company to outsource business needs that they cannot do better themselves (Turban et al., 2013). Organizations can improve alignment between ICT and business by outsourcing core competencies to cloud

computing (Andriole, 2012). Consequently, cloud computing's impact on organizations is the shift from a focus on the mechanics of ICT to a focus on business outcomes gained from ICT systems (Nirmala & Sridaran, 2012). Cloud is about delivering any ICT as a service (Andriole, 2012).

The success or failure of SMAC technologies requires practitioners to balance more than technological factors. For example, individuals and organizational behaviors will be the highest hurdle to cloud computing (Khan, Nicho, & Cooper, 2015; Shelton, 2013; Tan, Blake, Saleh, & Dustdar, 2013). Chen, Chiang, and Storey (2012) found that decision makers relied on big data to back up decisions made by intuition. As a result, the speed at which technologies involving SMAC technologies gained mainstream usage have left organizations trying to catch up. Businesses must retool their existing processes or replace the entire business with a new SMAC technologies-based business (Frank et al., 2014).

Strategic Alignment and SMAC Technologies

Aligning ICT with strategy is a significant problem for both industry practitioners and academic researchers. Strategic alignment between ICT and business has been a top 10 management problem since the longitudinal study by the Society for Information Management (SIM) began in 1980 (Kappelman et al., 2014). Practitioners consider strategic alignment a significant problem because ICT, business processes, and the operating environment are always changing. Similarly, academics considered strategic alignment a top 10 challenge because communicating the value of ICT to strategic alignment is a problem (Becker, vom Brocke, Heddier, & Seidel, 2015).

The challenge is so great because measuring the degree of alignment between ICT and business is difficult to quantify (Aversano, Grasso, & Tortorella, 2012). Furthermore, the process of aligning ICT with business strategy is subject to an intersection of factors acting on ICT and policy (Benson, Ribbers, & Bilstein, 2014). Positive or negative changes in the day-to-day environment, decision making, and advances in ICT can affect ICT (Gerow et al., 2014).

Several definitions of strategic alignment between businesses exist. ICT alignment as defined by Henderson and Venkatraman (1993) is the degree of fit and integration across business and ICT strategies, business, and ICT infrastructure. The definition of ICT alignment from Luftman (2004) is the application of ICT where there is a need promptly congruent with business strategies, goals, and needs. The definition of strategic alignment is what information systems and ICT architecture are required to support the business's strategic objectives (i.e., competitive advantages). A similar explanation from Howson and Hammond (2014) claimed that the definition of alignment is a combination of ICT staff and resources, and where the business employees and resources were working toward a common goal. Conversely, Gerow et al. (2014) argued that aligning ICT with business strategy might not lead to benefits for an organization. Gerow et al. (2014) claimed that alignment between business and ICT was not a goal but an ongoing process. Alignment between ICT can take on many forms depending on the organization's current crisis. Thus, strategic alignment is about having a malleable strategy and agile ICT to respond to changes in the operational environment (Gerow et al., 2014).

Numerous models exist to measure the degree of alignment between ICT and strategy. The strategic alignment model (SAM) was the first alignment model designed to measure the level of alignment or fit between ICT and business strategy (Aversano et al., 2012). Henderson and Venkataraman (1993) defined alignment as the ability to leverage technology to gain competitive advantage. The goal is to reduce or eliminate inefficiency in the provision and operation of the ICT infrastructure in concert with business strategy (Henderson & Venkataraman, 1993). The result is financial savings, speed, and quality of service (Coleman & Papp, 2006). Alignment is constantly shifting, which requires the strategy to change as external influences change. Therefore, the explanation of strategic fit is external fit describes competitive advantage, partnerships, and alliances. The explanation of internal fit describes the internal ICT infrastructure that supports the internal functions of the business. Hence, the organization must maximize two sets of ICT in conjunction with the strategy to gain advantages over competitors.

The SAM model has four components: (a) business strategy, (b) ICT strategy, (c) organizational infrastructure and process, and (d) information systems (IS) infrastructure and processes (Chan & Reich, 2007; Henderson & Venkataraman, 1993). Two components form the foundation for the SAM model: strategic fit achieved when business strategy addresses external and internal domains and functional integration achieved with the integrated business and ICT strategy (Henderson & Venkataraman, 1993).

The SAM model consists of four domains: (a) business strategy, (b) ICT strategy, (c) organizational infrastructure and process, and (d) IS infrastructure and processes (Henderson & Venkataraman, 1993). Each of the four domains consists of three

components: business strategy and organizational infrastructure and processes domains represent business, while the ICT strategy and the IS infrastructure and processes domains represent ICT. As a result, the degree of alignment between ICT and business is a matter how congruent strategy and ICT are with one another.

The SAM model has limitations depending on the industry (Thekahally, 2015); hence, extensions of the SAM model exist (Avison, Jones, Powell, & Wilson, 2004; Maes, Rijsenbrij, Truijens, & Goedvolk, 2000; Luftman, 2004). Maes et al. (2000) added that the information/communications domain and architecture and structure dimension. Chan and Reich (2007) added competition, organizational change, human resources issues, global ICT platform, and IS implementation process to the SAM model. The vision, mission, objectives, strategies, and tactics (VMOST) model splits strategy into components (Aversano et al., 2012). The model driven architecture (MDA) is to reduce the gap between business and ICT by using a methodological framework that links the business model with technology (Schlieter, Burwitz, Schönherr, & Benedict, 2015).

According to Benson et al. (2014), a significant part of the problem of aligning ICT and business is how alignment occurs. The success or failure of alignment between ICT and business strategy requires governance of ICT (Turban et al., 2013). ICT governance provides strategic direction, delivers value, risk management, resource management, and performance management (Turban et al., 2013). Wu et al. (2014) argued that governance was vital to proving the performance of ICT. ICT governance improves the return on ICT by nearly half. According to Wu et al., (2014) the factors that contribute to alignment between ICT and business are shared domain knowledge, IS/business planning sophistication, prior IS success, environmental uncertainty, and

organization size. Additional factors contributing to alignment between ICT and business include senior executive support, well-prioritized ICT projects, business-ICT partnerships, and CIO characteristics communication and planning.

The rise of digital business strategy, and innovation ecosystem, and value should guide research into alignment between ICT and strategy. The increase in digital business has shifted alignment between ICT and business to mean alignment between business and ICT (Dyché, 2015; Shelton, 2013). However, pursuing alignment based on changes in technology may lead to greater misalignment because organizations cannot keep pace with changes in the environment (Coltman, Paul, Rajeev, & Magno, 2015).

Misalignment between ICT and business occurs because, in certain circumstances, organizations are measuring alignment using unrealistic measures of performance (Coltman et al., 2015). Coltman et al.'s literature review on alignment showed that alignment between ICT and business models might be the wrong construct for measuring gains. Abcouwer and Smit (2015) asserted that alignment between ICT and business was a delusion. Coltman et al., (2015) citing a study by Hammer and Champy (1993), made the argument for ICT transformation meaning ICT led business strategy rather than ICT proceeding business strategy. However, Colman et al. (2015) claimed that alignment between ICT was an institution within some organizations. New definitions of alignment are necessary to match the 21st-century shifts in ICT, business, and society.

The need is because changes to the environment and technological change increase the complexity of alignment (Turban et al., 2013). Vessey and Ward (2013) argued that sustainable alignment was gaining in importance as advances in ICT have

quickened the pace and complexity of the business. The ICT systems of an organization must be able to provide value to the organization as the organization responds to or react to changes. Organizations would reliably benefit as long as they maintain alignment between ICT and the organization (Vessey & Ward, 2013).

According to Dulipovici and Robey (2013), seeking alignment between ICT and strategy does not guarantee increased alignment will occur. Dulipovici and Robey evaluated an ICT system designed to improve business strategy and found that it did not lead to increased use of a system or growing the business. The authors concluded that the system did not increase alignment because the various functional areas within the organizations had significant variance in their perspective of alignment and strategy. Hence, the interaction of different functional areas around ICT had an impact on the alignment between ICT and strategy.

SMAC technologies are causing companies to redefine alignment between ICT and business (Dyché, 2015; Shelton, 2013). One such change is SMAC technologies are an opportunity to create new possibilities for businesses to demonstrate value. According to Shelton (2013), SMAC technologies are valuable to business because billions of people are generating data from using SMAC technologies. Business can take this data created by the public and analyze it or feed to other applications and generate insights that might give them an edge in their marketplace.

Although SMAC technologies are valuable to business, SMAC technologies are changing how society functions (Shelton, 2013). People who own mobile devices can connect to the Internet and use social media applications to connect to others with simular interests instantly. Moreover, at the click of a button, people linked by an event can draw

the attention of authorities and shape public opinions almost immediately. SMAC technologies have made it easier, and faster for people to communicate, gain and share knowledge, but SMAC technologies is a complex system of components dependent on each other.

Shelton's definition of social is the exponential duplication of existing practices on a global scale because of the low cost of communication (Shelton, 2013). From a business perspective, social means connecting to networks of people and organizations to discover opportunities. Thus, the control of information gives way to connecting with people faster and in new forms.

Shelton's definition of mobile is using powerful mobile computing devices to engage with the world constantly without a physical connection (Shelton, 2013). Freedom combined with *always-on* connectivity means people have unprecedented access to information and tools. Mobile devices are analogous to carrying knowledge repositories including dictionaries and encyclopedias, instruments such as phones, global positioning, music players, and news such newspapers, television, radio, blogs, and podcasts (Shelton, 2013). From a business perspective, mobile allows businesses to connect with people and resources in the immediate conditions.

Shelton's definition of cloud computing is centralizing low-cost ICT hardware and software to provide efficiency and performance. Shelton combined cloud computing and analytics (Shelton, 2013). His justification was that analytics was a real-time processing of data to gain insight. Thus, it was a function enabled by cloud computing. The premise of Shelton's text was creating competitive advantages connecting with customers and receiving feedback in real-time (Shelton, 2013). Shelton (2013) argued

that ICT was a minor part of the equation. The significance of SMAC technologies is the change in people and organizations. Organizations of all types will have to understand they have to stay engaged with their customers 24 hours a day. Another reason that the broad distribution of connected individuals and technologies enables new ways of solving existing problems.

According to Shelton (2013), the major transformation will be in the change in the hierarchy of organizations. Previously, whoever controlled the information had the power. In the existing power structures, those individuals would be the most senior in the organization. This fact is no longer true because SMAC technologies shift the power to networks of individuals (Shelton, 2013). The result of SMAC technologies on business is the focus moving from controlling employees to empowering the employees to create results. This phenomenon will see organizations organized around information replacing traditional hierarchies (Shelton, 2013).

The text from Dyché (2015) is similar in tone to Shelton's book. She argued that SMAC technologies are shifting power to the creators of the data. The differences in the text are that Dychés focused more on the alignment between advanced ICT and strategy in detail. Dyché argued that ICT leaders have the difficult mission of transforming the ICT of organizations. The toughest part of the job of ICT leadership will be convincing organizational leadership to change their organizational strategy dramatically. ICT leaders face demonstrating the value of linking ICT and business strategy together to achieve results faster than a competitor can. For example, one reason for the failure of ICT to achieve strategy is that business leaders confuse short-term goals with strategy (Dyché, 2015). The impact of ICT is efficiency rather than ICT as an enabler of long-

term strategic goals. Moreover, ICT leaders will have to convince business leaders that the ICT managers role will change but continue to be a necessary function.

Dyché and Shelton's definitions of competitive advantage are similar. They agreed that the ICT and business landscape was causing a business to create a vision that was agile enough in ICT and strategy to meet the demands. The organizations that desire to prosper and lead will have to be able to reinvent themselves rather than reinforcing outmoded ideas. They also agreed that it was the leaders that would have to understand their current situation; understand their place in their industry or market, and learn fast with the help of ICT professionals. Therefore, gaining competitive advances from ICT, such as SMAC technologies, depends on recognizing and managing multiple factors (Dyché, 2015; Shelton, 2013).

Literature Review Related to the Research Questions

The previous sections consisted of the background on the factors contributing to interoperability failure. The organization of the section was by the primary reasons for interoperability failure. The literature review revealed the obvious problem of technical failures that plague first responder's ICT infrastructure. The failures of ICT initiatives designed to improve interoperability failure suggested that other causes are the reason for the problem to persist. Vassiliou and Alberts (2013) found that interoperability failure was not a technology problem but a failure by humans and organizations. The third reason for failure considered the strategies used to respond to major disasters. Laakso and Palomäki (2013) showed that first response organizations only prepared for routine disasters.

The literature review revealed a repeated pattern that ICT is at the whim of people, organizational strategy, and the environment (Allen et al., 2014; Vassiliou & Alberts, 2013). The body of literature is significant on interoperability failure, and it often refers to past interoperability failures. As a whole, it would suggest that interoperability failures occur in the initial phase of a major disaster where disaster response organization do not have a complete picture of the catastrophe. Therefore, a strategy is not in place to coordinate the actions of first response organizations (Brattberg, 2012). As a result, interoperability failures happen because ad hoc groups of first responders overextend their abilities and the capabilities of their ICT.

The success of SMAC technologies in the hands of disaster victims, and volunteers represents another chapter in the diffusion of SMAC technologies. The literature review suggested SMAC technologies is the future direction of how collaboration will occur during future major disasters. In an instant, disaster victims and volunteers were collaborating and creating solutions to the problem without formal organizations, massive budgets or prior coordination (Denis et al., 2012; Dugdale et al., 2012; Sarcevic et al., 2012). Hence, SMAC technologies may be the future direction in how advances in ICT will influence how first response organizations interoperate during future disasters.

The literature review demonstrated that research is taking place on the potential of SMAC technologies on disaster response. The majority of the research focused on the opinions of decision makers and first responders (Abbasi et al., 2012; Bressler et al., 2012; San Su et al., 2013; J. Yin et al., 2012). The data collection and analysis came from during simulated disasters. The remaining research consisted of document reviews,

semistructured interviews, and surveys on some aspect of SMAC technologies on collaboration during a disaster. An exception was the quantitative case study on SMAC technologies includes a pilot study by Chai and Kim (2012). The findings from the simulations and case studies revealed that decision makers and first responders did not have the necessary education (Abbasi et al., 2012; Bressler et al., 2012; San Su et al. (2013). Also, decision makers and first responder did not trust SMAC technologies either (Laakso & Palomäki, 2013; Laskey, 2013; San Su et al., 2013).

Brattberg (2012) suggested that interoperability failure is a problem because first responders' ICT is not congruent with actual disaster response strategy. The literature review on strategic alignment between ICT and business suggested that a leading management problem was aligning ICT and business strategy. The literature review showed that alignment between ICT and business strategy shared similarities with the problems faced by disaster response organizations.

Gaps in Current Literature

The literature review demonstrated that providing ICT that is interoperable between first response agencies is an urgent issue across all levels of first response agencies in the United States and internationally (Drouglazet et al., 2014; Fedorowicz et al., 2014). A small body of research exists on the lack of interoperability that considers alternative or additional reasons other than a technical reason for interoperability failure (Laakso & Palomäki, 2013; Scholl et al., 2012; Vassiliou & Alberts, 2013). However, a gap exists in the literature, which explores interoperability failure as a management problem.

Although broad changes will decide how first responders interoperate in the future, there is a gap in the literature that represents the ICT managers' understanding of the problem. There is almost no direct information on ICT managers' knowledge and experience with alignment between SMAC technologies and disaster response. Understanding the problem from all facets is necessary because some states will be early adopters of FirstNet (Goldstein, 2012). The state of Hawaii is one of those states. In addition, the state of Hawaii is also one of a group of states with the highest probability of a major disaster occurring (Wise, 2009). The choice of the state of Hawaii to be the first one to field broadband technologies is important because, as previously noted, FirstNet will not increase first responders' capabilities in the near-term. It is probable that first response agencies will have one network for routine disasters and another network in place for emergencies, which, in the initial phases, will not be interoperable. Operating competing ICT networks may increase the strain on members of disaster response organizations. Therefore, it is necessary to conduct a study on disaster agency ICT managers in the state of Hawaii to describe their understanding of alignment between SMAC technologies and disaster response.

Summary and Conclusions

Chapter 2 started with the conceptual framework, which discussed the sociotechnical theory. The sociotechnical theory provides insights into alignment between SMAC technologies and disaster response actions. The second section was a review of disaster response and interoperability. The literature review emphasized the difference between a disaster and major disaster and the importance of collaboration between first response agencies and preventing interoperability failure between first

response agencies during major emergencies. The third section was a review of the research on SMAC technologies and disaster response. The emphasis of the third section was to compare and contrast the literature on the benefits and challenges of SMAC technologies on disaster response. The fourth section was the literature review on the strategic alignment between ICT and business. The emphasis of the third section was on the factors that contributed to the degree of alignment between ICT and business strategy.

Disaster response is an issue of global importance as the nature of disasters continues to evolve (Scholl et al., 2012). Natural and human-made disasters are rising in criticality because the aftermath will affect more populations of people (Comfort et al., 2012). First response organizations in the United States are under pressure to be ready for the next disaster. Specifically, state and local first response organizations need ICT that is compatible or able to interoperate with the ICT of other first response agencies in the event of a major disaster (Trakas, 2012). A routine disaster is of small consequence to a single emergency response organization, but a major disaster requires multiple agencies to respond (Cabinet Office, 2012; Scholl et al., 2012).

In the United States, federal laws prescribe disaster response, and disaster response organizations have to follow an explicit set of rules or lose resources from the federal government (Wise, 2009). Disaster management frameworks try to set forth the rules to enable interagency first response organizations to work together in a seamless and coordinated manner (Brattberg, 2012). However, the evidence from the literature found that interoperability failure is a major threat to executing disaster response tasks.

A survey of the literature showed that interoperability is not as simple as fixing or replacing technology (Wise, 2009). Interoperable ICT is just a conduit for information flow. Interoperability can fail because the information cannot flow for some reason (Vassiliou & Alberts, 2013). Interoperability can fail because of complexity. Interoperability becomes a factor between first response agencies because they are dealing with the disaster in an informal status with incomplete knowledge and understanding (Vassiliou & Alberts, 2013). The failure comes when one or more parties do not get a critical piece of information (Kean & Hamilton, 2004).

Survivors of a major disaster may benefit from access to powerful forms of ICT to aid in their recovery. Evidence from the literature review indicates disaster victims will generate the most data from the disaster (Sherchan et al., 2012; Tene & Polonetsky, 2013). SMAC technologies will allow first responders to connect to other victims and loved ones faster than before because of SMAC technologies (Wendling, Radisch, & Jacobzone, 2013). Hence, SMAC technologies have a secondary function, which is creating social change by increasing the resiliency of disaster victims.

The problem is that first responders' ICT is lagging behind and will not catch up shortly despite massive investments (Moore, 2016). In the United States, the federal government gives the states large sums to improve interoperability between first response agencies. Previous efforts have had a small impact on the level of interoperability. Innovations in ICT and changes in federal policy made it possible for first responders to take a technological leap in improving interoperability (Goldstein, 2012). The drawback to this new interoperable network is that it may not provide the same level of capability that first response organizations were used to (Goldstein, 2012; Moore, 2016). Despite a

cost of three to one higher than previous efforts, first responders plan to maintain their legacy network (Moore, 2016).

First responders have tested SMAC technologies but do not understand how to leverage them to enhance disaster response strategies (Abbasi et al., 2012; Bressler et al., 2012; Hammon & Hippner, 2012; San Su et al., 2013; J. Yin et al., 2012). Furthermore, the lack of understanding by decision makers and first responders has contributed to their lack of trust of SMAC technologies (San Su et al., 2013). Leaders of disaster response organizations and first responders are overlooking opportunities to transform the effectiveness of collaboration during a response. In the United States, the result may be a shift in strategy in the aftermath of another interoperability failure during a major disaster. Only this time, the lack of interoperability with SMAC technologies and disaster victims will become the urgent issue.

Absent from the literature is an explanation from disaster response ICT managers. The lessons from the literature review are that disaster response organizations will have to shift their disaster response strategy to meet the needs of their citizens. The disaster victims and observers of the disaster will expect a change in strategy or the citizen-first responder will take action on their own. Furthermore, first response organizations' ICT will have to change to meet the technical needs to share information during a major disaster. Hence, alignment between SMAC technologies and disaster response is a matter of importance.

Chronicling the ICT managers' understanding of alignment is necessary because the literature revealed in related research that SMAC technologies are having a phenomenal impact on business (Dyché, 2015; Gasser et al., 2012; Newton, 2014;

Shelton, 2013). SMAC technologies are redefining the meaning of alignment between ICT and business (Dyché, 2015; Shelton, 2013). ICT is no longer in a supporting role behind the strategy, ICT is leading the formation of strategy. However, in private organizations, the central problem for ICT managers is alignment between ICT and business (Kappelman et al., 2014). The body of research demonstrated that SMAC technologies would have unprecedented impacts in the future that may be costly. A picture of ICT managers' understanding of alignment between SMAC technologies and disaster response is required.

In Chapter 2, I presented the conceptual framework, literature review of key concepts, literature review related to the research questions, gaps in the literature, and summary and conclusions. Chapter 3 described the qualitative research design selected to answer the research questions. In addition, Chapter 3 explained the rationale, role of the researcher, methodology, and ethical procedures.

Chapter 3: Research Method

The purpose of conducting this study was to explore ICT managers' level of understanding of alignment between SMAC technologies and disaster response. Research has revealed the minimal value placed on investments in ICT advancements because of a misalignment between the ICT used by first response organizations and disaster response strategies (Vogt et al. 2011). However, misalignment has not prevented the federal government of the United States from pursuing expensive ICT projects designed to improve interoperability. The DHS continues to invest billions of dollars annually into improving the process of interoperability between state and local first responders with no return on investment (Goldstein, 2012, Moore, 2016, Peha, 2013). Without the ICT or strategies necessary to be effective during major disasters, first response agencies might not be able to save as many lives or prevent greater devastation from occurring.

Analyzing past research, I noticed that SMAC technologies had displayed the potential to close this gap, but research is missing on the application of SMAC technologies in the context of the problem of the lack of interoperability between first response agencies. By creating a SMAC technologies and disaster response framework, the value of ICT initiatives designed to improve interoperability may increase because of lower ICT infrastructure costs, enhanced technology, and improved information sharing for disaster response organizations. The findings from conducting this study may help ad-hoc formations of disaster responders from multiple state and local agencies in the United States become more efficient at sharing information and deploying resources during major disasters.

A qualitative grounded theory approach allows the researcher to develop a new theory from the collection of data instead of being reliant on existing theory (Birks & Mills, 2011; Glaser & Strauss, 1967). I used a qualitative grounded theory approach and collect data from semistructured interviews with a purposive sample of ICT managers from a disaster response agency. I analyzed the data using open coding, axial coding, selective coding, constant comparative analysis, theoretical sampling, and memoing to attempt to generate a new theory. I ensured the credibility, reliability, and validity of this study by taking affirmative steps to protect the process and data from bias. I used data triangulation to protect the quality and truthfulness of the findings from this study. I used evidence from the two data collection sources. I collected data using an interview questionnaire and documentation provided by the participants.

I begin Chapter 3 with a description of the research design and rationale, research questions, selection of research method, and role of the researcher. The next section begins with a description of the methodology. The next section includes the participant selection logic, recruitment of participants, instrumentation, and member checking. The next section describes the procedures for recruitment, participation, rationale for ground theory, Delphi technique, participation, and data collection. In addition, this section contains the relationship between the interview questions and the research questions, and the qualitative interview guide. The next section described the data analysis plan. I finish Chapter 3 with an explanation of trustworthiness and describe the procedures to ensure and enhance integrity and concludes with a summary.

Research Design and Rationale

Aligning ICT with business strategy to achieve organizational objectives is challenging because demonstrating the value of ICT is hard. For example, the DHS spends billions of dollars annually in the United States on ICT initiatives designed to support strategic frameworks. The initiatives are designed to ensure first responders can share information between agencies during a disaster. However, when a disaster of significant magnitude happens, the response effort is hampered in some way or lives are loss due to ICT failures (Comfort et al., 2012).

Employing SMAC technologies and interoperating with disaster victims might improve interoperability and increase the value of ICT to emergency management during disasters. However, currently, decision makers and first responders from disaster response agencies do not have the training nor do they trust SMAC technologies. The problem is a gap in the information on ICT managers' understanding of how to align SMAC technologies with disaster response. A SMAC technologies and disaster response framework would contribute to the ongoing discussion of the value of advances in ICT to disaster response. It is inevitable that SMAC technologies will play a role in the outcomes of future catastrophes (Dugdale et al., 2012, Sarcevic et al., 2012). Therefore, answering the primary research and sub research questions are vital.

Research Questions

Research is about understanding an important issue (Stake, 2010), and the research questions need to align with the research paradigm and research methods (Reiter, Stewart, Bruce, 2011; R. Yin, 2013). I addressed in this study the phenomenon of strategic alignment process between SMAC technologies and disaster response strategies.

ICT alignment, as defined by Henderson and Venkatraman (1993), is the degree of fit and integration across business and ICT strategies, business, and ICT infrastructure. The definition of ICT alignment from Luftman (2004) is the application of ICT where there is a need promptly and in congruence with business strategies, goals, and needs. The definition of SMAC technologies is leveraging the strengths and interdependence of social media, mobile, analytics, and cloud computing to gain competitive advantages over other organizations.

I used a qualitative research methodology for this study. A qualitative methodology was appropriate because the research questions were open-ended (R. Yin, 2013). Furthermore, the purpose of grounded theory was to generate a theory when there is scant information about a phenomenon (Corbin & Strauss, 2008). An in-depth exploration of ICT managers' level of understanding of alignment between SMAC technologies and disaster response is necessary, as there is scant literature on SMAC technologies and strategic alignment in the context of disaster response organizations in the United States. This qualitative study focused on a single research question and two sub research questions:

> RQ1: What is the level of understanding of alignment between SMAC technologies and disaster response strategies for ICT managers from disaster response agencies?
>
> SQ1: How does the prevalence of SMAC technologies influence ICT managers' perspectives toward ICT initiatives and disaster management frameworks?
>
> SQ2: How can exploring ICT managers' level of understanding of alignment between SMAC technologies and disaster response generate a new theory?

A qualitative methodology refers to the broad perspectives from which research makes the investigation, draws inferences, and views the problem (Stake, 2010). Qualitative data are not numerical data and may be in an unstructured form (i.e., notes, transcripts, interviews, emails, audio-visual artifacts, and so forth) (Kuckartz, 2014). A qualitative research approach is relevant in this study because to answer the research questions requires the understanding of the awareness and skill of the participants (Stake, 2010).

Selection of Research Method

The grounded theory approach allows the researcher to develop a new theory from the collection of data instead of data being reliant on the theory (Birks & Mills, 2011, Glaser & Strauss, 1967). According to Charmaz (1990), the purpose of grounded theory approach is to generate a theory in the case where not much is information is known about a topic. A grounded theory emerges from interdependent stages that are repetitive until theoretical saturation occurs (Bitsch, 2005). Therefore, developing a grounded theory is not an outcome but materializes from a process of simultaneous data analysis and collection (Burden & Roodt, 2007).

The grounded theory requires the systematic use of analytic tools to conduct a comparison of data (Urquhart, Lehmann, & Myers, 2009). The grounded theory approach to this study allowed me to attempt to generate a new theory by collecting data from ICT managers using a document review and semistructured interviews. There are three different grounded theory research designs: (a) the emerging design, (b) the constructivist design, and (c) the systematic design (Miller & Salkind, 2002). Glaser (1992) advanced the emerging design, which allows the researcher to build a theory by what emerges from

data rather than existing categories. The constructivist design is a modern grounded theory design linked to a student of Glaser, Kathy Charmaz (Miller & Salkind, 2002). Charmaz (1990) argued for active codes because the individuals involved in the research study influence the process. For this study, I used a systematic grounded theory design from Corbin and Strauss (1990).

The application of grounded theory approach appears numerous times in information technology research (Urquhart et al., 2009). Matavire and Brown (2008) argued that IT systems processes generate varieties of data that apply to many types of circumstances. Comparative analysis by definition is congruent with the ever-changing environment of the information systems field (Matavire & Brown, 2008). According to Mavetera and Kroeze (2009), the collection of more data and adding it to the data set increases the understanding of the problem by the researcher. Both Mavetera and Kroeze as well as Zikmund, Babin, Carr, and Griffin (2003) asserted that grounded theory is a fit for environments that are constantly changing and experiencing uncertainty.

The sociotechnical theory grounds the study and provides a lens for understanding that a combination of technical, people, and organizational factors influence the alignment process between SMAC technologies and disaster response. I conducted this study to allow ICT managers to describe from their perspective the factors that may increase alignment between SMAC technologies and disaster response actions. Learning about these factors may result in new strategies during major disasters that incorporates SMAC technologies and two-way collaboration with disaster victims.

Role of the Researcher

In qualitative studies, a researcher is a tool applied to complete the study (Sanjari, Bahramnezhad, Fomani, Shoghi, & Cheraghi, 2014). According to Unluer (2012), the credibility of qualitative research depends on researchers spelling out their roles in the research. For this study, I followed the grounded theory approach espoused by Corbin and Strauss (2008). Corbin and Strauss (1990) are responsible for the systematic design. A systematic design typically focuses on categorization and coding (Miller & Salkind, 2002).

The functions required of me to complete this study were that of a participant observer, interviewer, investigator, data analyst, and writer (Denzin & Lincoln, 2011). I was responsible for developing the interview questions, documents review matrix, selecting the population, and sampling the participants for this study. I used the Delphi technique to gain consensus from a panel of experts to validate the interview questions and the document review matrix. I was responsible for conducting the Delphi technique to ensure the interview questions, and document review matrix is relevant, does not lead the participant, and to mitigate bias in the interview questions (Gobo & Mauceri, 2014).

I was responsible for certifying the potential participants who meet the criteria for selection and then recruiting them for this study. I was responsible for obtaining permission to conduct the study from the participating organization and obtaining written consent from the participants. I collected data from multiple sources (R. Yin, 2013). I collected data by collecting documents and conducting semistructured interviews with the participants. I transcribed, coded, and analyzed the qualitative data collected from the interviews to determine the major themes and findings of this study. Finally, I protected

the participants from bias, protected their identities and privacy, and protected the data collected from the participants.

At the time of conducting this research, I am an ICT project manager. I am responsible for a variety of ICT projects designed to improve interoperability between two or more separate organizations during a crisis. In addition, I was formerly a Department of Defense first responder. Thus, I bring a practical experience and as a user in understanding the challenges of implementing ICT to allow leaders and practitioners to interoperate across diverse organizations during a major crisis. My profession has brought me into contact with different types of first response agencies, international institutions, and nongovernmental organizations. The one exception is I have no direct experience with state-level first response organizations in my current role as a project manager or former role as a first responder. However, my personal and professional bias may influence the collection of the data and analysis. I addressed how I managed this bias further in this section.

My professional experience with first response agencies at the state level has been in business development. I spent 2 years in the field of business development marketing ICT to first response agencies. In the course of the project with a federal government customer, I have had technical briefings and demonstrations with first response organizations from the federal level to the state level in Hawaii. I have had no other type of relationship with members of either the federal or state first response organizations. Because of this prior relationship, I have established credibility with leaders from the organizations that recruited the population I needed for this study. To manage my relationship with these organizations, I used purposive sampling strategy.

Because I am the participant observer, interviewer, investigator, data analyst, and writer, I made certain I did not provide undue influence on the participants (Golkar & Crawley, 2014; Houghton et al., 2013). To manage the ethical challenges and minimize bias that may have arisen, I employed four strategies: confirmability, dependability, credibility, and transferability (Lincoln & Guba, 1985). In addition, I made notes in a reflective journal throughout the data collection and analysis process on the perceptions I may have had (Tufford & Newman, 2012). I used triangulation and member checking to ensure the consistency of the collection of data (Patton, 2015).

Methodology

For this study, my research questions mandated a qualitative research approach (Singleton, Straits, & Straits, 2010). In this study, I collected qualitative data by conducting semistructured interviews with a sample of disaster agency ICT managers using an interview questionnaire (see Appendix B). I strengthened the collection of data by examining relevant documents provided by the disaster agency ICT managers using a document review matrix (see Appendix C). My goal was to explore what ICT managers' knew about how SMAC technologies might influence disaster response strategies, so I coded data into relevant themes to answer the research questions.

Participant Selection Logic

The setting for the study was personnel from various emergency management agencies at the state level who were responsible for the initial response to a major disaster within the state of Hawaii. I selected the state of Hawaii as the location for this study because the state of Hawaii is at higher risk than are other states for the occurrence of a disaster (National Earthquake Hazards Reduction Program, 2015). In addition, the state

of Hawaii is one of the prototype states for FirstNet (Goldstein, 2015). The population for this study were disaster agency ICT managers from state-level first response agencies within the state of Hawaii.

The participants included disaster agency ICT managers who meet the criteria for inclusion in this study. First, at the time of data collection, the ICT manager had to be a member of the staff for a state level agency identified as a first response agency within the state of Hawaii. The ICT management staff must have been directly responsible for the design, acquisition, governance, and operation of the ICT used by the organization's decision makers and first responders during a major disaster. Second, each participant must have been an employee of a state-level first response agency for at least one year and have participated in the annual statewide disaster management exercise (Cabucu, 2015).

Because the most critical element in the successful completion of a study is the selection of participants (Sargeant, 2010), I used purposive sampling to select the appropriate participants to answer the research questions (Teddlie & Tashakkori, 2009). This sampling also works for studies small in scope or situations that bar random selection (Singleton et al., 2010), which addresses the importance of sample size reflecting an adequate number to answer the research questions (Merriam, 2009). According to Patten (2015), a sample of 14 is a suitable average number of participants needed for a qualitative study; however, in a qualitative study, and depending on the research methodology (Walker, 2012), researchers will continue to sample until the data becomes redundant or when the interviews yield no new information (Morse, 2007; Bryman, 2012). Because this study used a grounded theory design, I conducted

interviews and used a document review matrix to collect data. I continued to sample until I reached saturation (Glaser & Strauss, 1967).

I recruited the participants and sought the necessary permission and consent to conduct interviews. I used professional contacts within my place of work to introduce me to potential participants who meet the selection criteria for this study. Then, I randomly selected nine participants from the pool of 25 ICT managers who met the criteria.

I contacted the participants in this study in person or via email, or telephone. I emailed or mailed an invitation (see Appendix D), a consent form, and a synopsis outlining the purpose and importance of the study to each participant. The participants were given 10 days to respond via phone, email, or mail if they were interested in participating in this study. In addition, I informed the participants, using the confidentiality agreement (see Appendix E), that their participation in the study and their identities would remain confidential. In addition, I informed the participants, using the confidentiality form, they could withdraw from participating in this study at any stage with no repercussions. I informed the participants that I would securely store all physical and electronic copies of the recordings, notes, transcripts, storage media in two separate but secure locations (Ritchie, Lewis, Nicholls, & Ormston, 2013) for 5 years. After the 5 years, data will be destroyed by a certified document destruction service.

Instrumentation

A researcher uses many types of methods to collect data during a qualitative study to answer the research questions (Stake, 2010). The methods include observation, interviewing, and surveys (Stake, 2010). For this study, I used an open-ended interview questionnaire (see Appendix B), and a document review matrix (see Appendix C). A

structured interview questionnaire ensured the researcher answers the research questions adequately, and that data collection on the phenomenon of interest, and the knowledge and experiences of the participants.

I created the interview questionnaire and the documents matrix directly from the research questions. I chose to develop the interview questionnaire myself because minimal current research exists on the concepts of interest. I created the interview questionnaire from examples in the literature. I used the Delphi technique to gain consensus from a panel of experts to validate the interview questions and document matrix.

I chose the document review matrix because the literature demonstrated that disaster response organizations' culture, funding, actions emerge from different forms of documentation. In addition, I used the Delphi technique to gain consensus from a panel of experts to validate the interview questions and document review. Therefore, it is plausible to proclaim that the instruments for this study were both appropriate and sufficient for their purpose. I used an interview questionnaire (see Appendix B) to conduct the semistructured interviews. The interview guide consisted of open-ended questions (Myers, 2013).

According to Patton (2015), qualitative inquiry seeks to avoid receiving calculated or fixed answers during the interview by creating a question that allows the participants to answer in their words. Interview questions with fixed answers limit the potential answers. Using interview questions that force the participant into one direction or another is evident to the interviewer and participant (Patton, 2015).

I augmented the data collection from the interviews with a review of publicly available documents suggested by the participants. I used a spreadsheet (see Appendix C) with headings similar to a literature review matrix to organize the documents collected from the participants. The spreadsheet allowed me to capture and organize the material by major theme for consideration after the interviews (Myers, 2013).

Lodico et al. (2010) defined an interview as a purposeful conversation where the participants express their thoughts in their words. According to Wahyuni (2012), semistructured interviews are the best way to answer open-ended questions where it is important to understand the point of view of the participants. I conducted interviews with a sample of disaster agency ICT managers from a first response organization within the state of Hawaii. I conducted interviews separately with nine disaster agency ICT managers until I reached data saturation (Bryman, 2012). The interviews reach saturation when the interviewer receives no new information, no new themes, and the ability to replicate the results (Bryman, 2012).

Hanson, Balmer, and Giardino (2011) reported that four to six well developed; open-ended questions often produce productive interaction and detail. I used 10 open-ended questions developed by me (Hanson et al., 2011). I contacted the participants individually to set up a date, time, and location of their preference. The participants received a copy of the interview questionnaire (see Appendix B) to review before the interview date. I informed the participants that the interview is a one-on-one interview estimated to last 30 to 45 minutes. Finally, I informed the participants that there is no compensation for their participation.

I conducted the interviews in a public location of the participant's convenience or at a place prepared for in-person interviews that is comfortable and ensures privacy. On the day of the meeting, I ensured the participant was comfortable, and briefed him or her on the purpose of the study and the importance of his or her participation. I reminded the participant again of the protections as a participant. I recorded all interviews using a primary and a backup digital recorder. I used the same interview questions for all the participants. I asked follow-up questions as the situation dictated.

I supplemented the recording with handwritten notes. I took a limited amount of notes during the interview. After each interview, I transcribed the notes into Microsoft Word. Finally, I delivered the final copy to each participant for his or her review as soon as possible after the initial interview.

Member Checking

I improved the verification of the data by member checking. Member checking is a process to minimize any inconsistencies in the data collected (Patton, 2015). In addition, member checking provided the opportunity for the participant to ensure his or her answers were accurate (Houghton et al., 2013). At the end of each participant's interview, I transcribed the audio from the interview into text. I shared the text with the participant in a follow-up interview to verify with the participant that the information was accurate. Participants had 5 days to provide any corrections or feedback. None of the participant suggested corrections. Once approved by the participant, I uploaded the interview transcription from each participant into NVivo11.

I used a document review as an additional stream of data to corroborate and augment the data collection from the interviews. Singleton et al. (2010) identified five primary sources of available data as (a) public documents, (b) mass media, (c) personal or private documents, (d) nonverbal, and (e) archival sources. Singleton et al. suggested that the use of publicly available data is probably the most credible sources of information. I used publicly available documents, which the participants suggested, to describe disaster response agency ICT managers' understanding of alignment between SMAC technologies and disaster response actions.

Pilot Study

In this pilot study, I used the Delphi technique to gain consensus from a panel of experts to validate the interview protocol (see Appendix A), interview questionnaire (see Appendix F) and the document review matrix (see Appendix H). In the 1950s, Dalkey and Helmer (1963) developed the Delphi technique. Typically, in a conduct of the qualitative study, a pilot study is used (Leon, Davis, & Kraemerm, 2010). A pilot study is used to test the feasibility of the study procedure, data collection instruments or intervention to be employed in the conduct of a larger study. I chose to use the Delphi technique because there was limited knowledge about the problem. The goal of the Delphi technique was to gather the collective insights from experts on the problem; reveal new opportunities, and potential solutions (Skulmoski, Hartman, & Krahn, 2007). Hence, the Delphi offered the chance to test my data collection procedures, data collection instruments, as well as gain additional information on the problem before the main study.

The Delphi technique gathers the expertise and opinions of a panel of experts to form a consensus on a real-world topic (Dalkey & Helmer, 1963). According to Hsu and Sandford (2007), the Delphi technique keeps a single person from controlling the opinion of the group by providing participants the opportunity to provide their opinion privately. Williams and Webb (1994) described the Delphi method as "the systematic collection and aggregation of informed judgments from a group of experts on specific questions or issues" (p. 180).

Although the Delphi technique is a widely accepted technique (Hsu, 2007), caution must be taken to mitigate potential bias when selecting experts (Keeney, Hasson, & McKenna, 2006; Landeta, Barrutia, & Lertxundi, 2011). No consensus exists on the required number of experts (Powell, 2003). I chose five professional colleagues for their background in managing ICT for public organizations tasked with providing interoperability ICT in preparation for or during a major crisis. Three of the experts were ICT managers as well as doctoral students enrolled in an accredited management degree program. Two of the experts were senior level ICT managers in the organization I worked with because they were responsible for leading a medium size ICT organization. However, more experts might have increased the reliability (Murphy et al., 1998), but in this study, I selected five experts because of available resources and time (Hasson, Keeney, & McKenna, 2000).

The Delphi technique followed the same ethical standards as the primary study. Before collecting data, permission to collect data was granted by the Walden University IRB. The IRB approval number is 02-23-17-0113816 and it expires on February 22, 2018. I sent each of the potential participants in the Delphi study an invitation to

participate (see Appendix G). I informed the participants in the Delphi study that their participation was voluntary by asking them to sign an informed consent form, and they could exit the Delphi technique at any time (Policy & Guidance, 2010). I contacted the experts in person, via phone, and email to ask their assistance to review the guiding interview questions and to examine the document review matrix (see Appendix H). Once I gained agreement for the experts for their participation, I provided a summary of the study, a list of the guiding interview questions, and the document review matrix, to provide feedback on the interview questions and document review matrix (Hasson et al., 2000).

Data gathered during the Delphi study ensured that the interview questions were not ambiguous and easily understood by the participants. In addition, the Delphi technique tested the document collection matrix to ensure the participants understand the criteria, and they apply to answering the research questions. The guiding interview questions for the Delphi technique were 10 interview questions (see Appendix F). Based on the feedback from the experts, I corrected any issues or concerns with the interview questions and the document review procedures by adding, deleting, or restating the questions and refining the document collection methods (R. Yin, 2013). I did not use data collected during the Delphi technique in the main study. However, data collected during the Delphi technique received the same protections of data as the main study.

Procedures for Recruitment, Participation, and Data Collection

I recruited participants from disaster response organizations because of their direct involvement in the phenomenon of interest. I chose the potential participants for their firsthand knowledge and experience in providing interoperable ICT for decision

makers and first responders during routine operations and during major disasters. Once I had a population of ICT managers, I formed a roster from the population of ICT managers and used a purposive sampling strategy to select 25 disaster agency ICT managers.

I contacted the potential participants in person, via email or telephone. I sent each potential participant a letter of invitation (see Appendix D) to participate in the study. If the participant accepted the invitation, I scheduled a time and place to conduct the interview. Before beginning the interview, I provided the potential participants with a consent form (see Appendix E). I explained the purpose of this study and importance of conducting this study. I informed the potential participants that I would be collecting data from them using a document review and semistructured interviews. I informed the participants that at the end of the interview, I would return the transcript of the interview to them for their review.

I informed the potential participants that I would protect their privacy and confidentiality throughout the entire study process. The member checking process served as the process to exit the study. I informed the participant if I needed to conduct a follow-up interview. I informed the potential participants that they could withdraw from this study without penalty. If a participant decides to exit the study before I publish the study, I informed him or her of the ethical protections (Office for Human Research Protections, 2016). Participants in the study were assigned codes, which eliminated identifiable private information (Office for Human Research Protections, 2016), which could identify them (Damianakis & Woodford, (2012). Participant participation in this study was low.

The participants whom I contacted that began the study continued with the study to the end.

The goal of this research study was to explore ICT managers' level of understanding of SMAC technologies with disaster response. Grounded theory is a method researchers use to create a theoretical framework from a phenomenon for which not much research exists, or it is hard to explain (Glaser, 1992). The three most common grounded theory research designs are systematic design, the emerging design, and the constructivist design (Miller & Salkind, 2002). The emerging design allows the researcher to build a theory by what emerges from data rather than existing categories (Glaser, 1992). The constructivist design is the newest grounded theory design linked to a student of Glaser, Kathy Charmaz (Miller & Salkind, 2002). Charmaz (1990) argued for active codes because the individuals involved in the research study influence the process.

I followed the data analysis approach of Corbin and Strauss (2008). Corbin and Strauss advocated that a theoretical framework was needed in the beginning. Corbin and Strauss's approach to data analysis included open coding, axial coding, and selective coding. Open coding is a concept of sifting data into the initial concepts. Axial coding is the next step in the process where the researcher establishes a relationship between concepts and categories. Selective coding is the last step in the coding process where the researcher chooses a central category and systematically relates it to other categories. Finally, I used a codebook as I collect data to code and sort data. During the open coding phase of the study, I used NVivo11 to maintain the codebook.

According to R. Yin (2013), the categorization of data collection is usually in four groups: (a) interviews, (b) observations, (c) documents, and (d) physical materials. For this study, I obtained data from the participants through semistructured interviews and a document review. Lodico et al. (2010) defined an interview as a purposive conversation where the participants express their thoughts in their words. The advantage of interviews are that they allow the researcher to focus on a specific topic and to gain insights (R. Yin, 2013). The benefit of observations is that they occur in real-time and are unique to the situation. Documents are of benefit because they are repeatable, capture extensive information on many things, and are specific. The advantage of physical materials is they can provide deeper cultural or specialized understanding of the topic (R. Yin, 2013).

The disadvantage of conducting interviews is that biases can intrude because of problems with the questions and participants (R. Yin, 2013). The drawbacks of records are they can be difficult to discover or to access by design or deliberately; or contain skewed or bias information. The disadvantage of physical artifacts is the opportunities to handle artifacts in their natural setting (R. Yin, 2013).

I collected data from semistructured interviews, and a document review. First, I conducted interviews with disaster agency ICT managers using semistructured interviews. Second, to augment the interviews, I collected documents (e.g., regulations, standard operating procedures [SOPS], emails, and online data repositories) (R. Yin, 2013). Thee data collection and data analysis processes is shown in (see Figure 1).

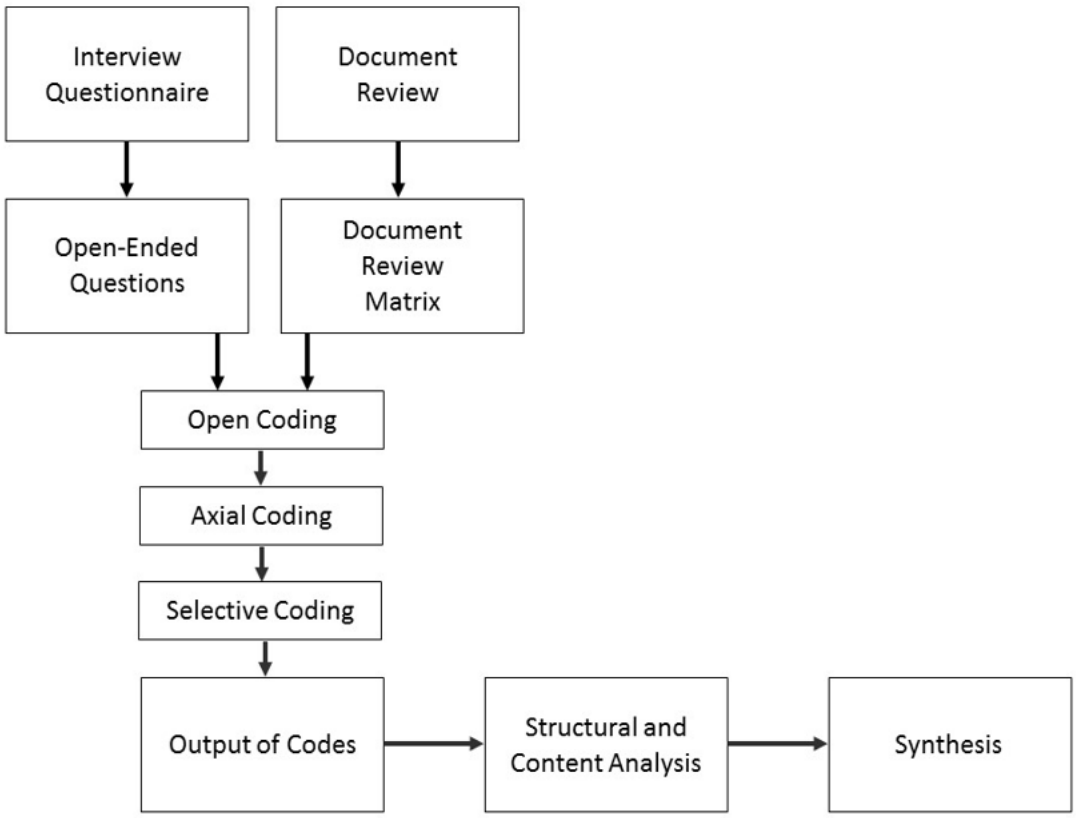

Figure 1. Qualitative data collection and data analysis process.

I obtained approval to conduct this study from the Walden University Internal Review Board (IRB), then I used the Delphi technique to gain consensus from a panel of experts to validate the interview questions and document review matrix. I interviewed five experts in the field of ICT, three of whom were doctoral candidates to gauge the quality of the interview questions and the document matrix. One of the participants dropped out of the study before returning their assessments of the interview questionnaire and document review matrix.

I sent the participants a read-ahead copy of the interview questionnaire (see Appendix B). I provided no financial incentives to the participants to participate in the interviews. I arranged an interview with each of the participants at his or her

convenience. I ensured the location afforded the participant sufficient privacy and comfort. I interviewed nine participants until I reached data saturation (Bryman, 2012).

I asked open-ended questions from an interview questionnaire (see Appendix B) that I developed myself and tested using the Delphi technique before beginning the interview process (Myers, 2013). I spent approximately 30 to 45 minutes asking the participants 10 open-ended interview questions from guiding interview questions created by me. I recorded each interview using a digital recorder. At the end of each interview, I expressed my gratitude to the participants for their participation in the study. I informed the participants that I would keep the data in all forms manual and electronic in a redundant, secure facility for 5 years. At the end of the 5-year period, I would destroy all data. Finally, after each interview was complete and data transcribed, I used member checking to confirm with the participant that his or her responses were correct and complete. I conducted follow-up interviews when needed. Once the data collection was completed, I analyzed the data using CAQDAS.

The purpose of the interview questions is to answer the research questions. The open-ended interview questions are to support semistructured interviews. The semistructured interview process permitted me the flexibility to deviate as the interviews unfold to collect in-depth responses to the research questions (Doody & Noonan, 2013). The research questions were the following:

> RQ1: What is the ICT managers' from disaster response agencies level of understanding of alignment between SMAC technologies and disaster response strategies?

SQ1: How does the prevalence of SMAC technologies influence ICT managers' perspectives toward ICT initiatives and disaster management frameworks?

SQ2: How can exploring ICT managers' level of understanding of alignment between SMAC technologies and disaster response generate a new theory?

Below are the semistructured interview questions:

1. What is your definition of interoperability between disaster response agencies during a major emergency?
2. How would you describe interoperability failure between disaster response agencies during a major crisis?
3. Briefly, describe your organization's standard operating procedures for sharing information with external disaster response agencies during a major emergency?
4. Describe your professional experience with social media mobile analytics and cloud computing technologies?
5. Describe your experiences with emergency management organizations using social media mobile analytics and cloud computing technologies during a disaster response exercise or real-world event?
6. Describe your experience with disaster response frameworks (i.e. National Incident Response System and Incident Command System)?
7. What has been the impact of social media mobile analytics and cloud computing technologies on information and communications technology initiatives and disaster response frameworks?

8. Could you provide an example of how social media mobile analytics and cloud computing technologies could positively impact the quality and effectiveness of emergency management during major disasters?
9. What is your opinion of disaster response organizations using social media mobile analytics and cloud computing technologies to collaborate with disaster victims during a major disaster?
10. What additional printed or electronic documents, websites, blogs, or videos could you recommend providing supplementary information on what we discussed today?

I followed the framework outlined by Qu and Dumay (2011) to develop the interview questions that I used during the conduct of the semistructured interview process. The definition of a semistructured interview is systematically asking questions guided by established themes (Qu & Dumay, 2011). A table adapted from Kvale's (1996, p. 133-135) typology of questions provided an overview of the interview questions, the purpose of interview question and sample questions. The qualitative interview quide is shown below (see Table 1).

Table 1

Qualitative Interview Guide

Type of Question	Purpose	Example
Introduction	To initiate the beginning of the interview	What is your definition of interoperability between disaster response agencies during a major emergency?
Direct Questions	To collect data from participant	How would you describe interoperability failure between disaster response agencies during a major crisis?
Specifying Questions	To develop more precise descriptions from general statements	Describe your professional experience with social media mobile analytics and cloud computing technologies?
Indirect Questions	To pose projective questions	Briefly, describe your organization's standard operating procedures for sharing information with external disaster response agencies during a major emergency?
Follow-up Questions	To direct questioning to what has just been said	What is your opinion of disaster response organizations using social media mobile analytics and cloud computing technologies to collaborate with disaster victims during a major disaster?
Probing Questions	To draw out complete narratives	Could you provide an example of how social media mobile analytics and cloud computing technologies could positively impact the quality and effectiveness of emergency management during major disasters?
Silence	Allow the participants' time to reflect and contribute significant information.	N/A

Data Analysis Plan

The objective of the data analysis process is to analyze data collected to answer the research questions (Merriam, 2009). The answers to the questions are also known as themes and categories. To begin to respond to the research questions, the researcher must segment data set into smaller segments, which correspond to each research question (Merriam, 2009). Rubin and Rubin (2011) suggested that the researcher should regularly review interview notes looking for categories or themes.

The data analysis phase of a grounded theory study is continuous. There are three stages in the data analysis process. First, the researcher categorizes data from the data collection; additional data comes from analyzing the first set of data, then in the last stage, the theory should emerge (Birks & Mills, 2011). Data coding and analysis in a grounded theory study uses the following three techniques: (a) open coding, (b) axial coding, and (c) selective coding (Strauss & Corbin, 1998).

I followed the typical grounded theory data analysis approach. According to Glaser and Strauss (1967), grounded theory analysis includes open-coding, axial coding, and theoretical sampling in conjunction with the constant comparative method. The qualitative data came from the literature review, a document review and semistructured interviews. I used NVivo11 to store and analyze the level of codes.

Open codes describe the phenomenon found in the text. In a grounded theory study, open coding is the first step in coding that identifies the initial categories or sample (Bitsch, 2005). I used data analysis software to code the data (Myers, 2013). I systematically organized the findings into categories (Lawrence & Tar, 2013). After distilling the initial data collected, I went to the next step, which is axis coding.

Urquhart et al. (2009) developed axis coding. Axis coding is the part of the coding process that introduces subcategories to process (Strauss & Corbin, 1998). The data analysis occurs on two axes (Urquhart et al., 2009). The first axis is the degree of conceptualization, and the second axis is theory scope. According to Bitsch (2005), during axis coding, the researcher introduces data to try to find faults in the emerging theory. In this step, axial coding combines data into themes (Saldana, 2009). The connection between the themes leads to the generation of a theory (Birks & Mills, 2001; Bitsch, 2005).

Selective coding is the third technique, which integrates the categories and subcategories and validates their relationships (Benecke, Schurink & Roodt, 2007; Burden & Roodt, 2009). At this stage in the coding process, according to Corbin and Strauss (1990), "The categories are unified around a core category" (p. 424). The researcher uses this stage to test the variation between samples and any new details.

The definition of theoretical sampling is collecting data to provide a foundation for an eventual theory (Goldkuhl & Cronholm, 2010). Dennis and Hale (2011) defined theoretical sampling as the repetitious collecting and analyzing data to refine the development of the eventual theory. At this point in the process, saturation occurs when theoretical sampling produces no new information (Burden & Roodt, 2009).

For a grounded theory study, comparative analysis is the systematic process that leads to generating a theory from comparing open coding and axial coding (Glaser & Strauss, 1967). Constant comparative analysis is a data analysis technique that distills the many categories into central categories (Burden & Roodt, 2007).

I maintained memos and theoretical notes as a component of the constant comparative process. Glaser (2014) defined theoretical memos as a technique to capture the researcher's interpretation of the relationships between codes. According to Scott (2009) and Hernandez (2009), theoretical memos capture the potential relationships between codes. Memoing allowed for creating a new category not already captured during data collection (Glaser & Strauss, 1967). Glaser and Strauss established a process for recording incidents or observations into memos not gathered during the data collection process.

I used Computer Assisted Qualitative Data Analysis Software (CAQDAS) to aid me to organize and categorize data collected from the interviews and document review (Merriam, 2009). Researchers use CAQDAS to analyze data from interviews, focus groups, documents, field notes, and open-ended survey responses (Woods, Paulus, Atkins, & Macklin, 2015). The motivation to use CAQDAS was its ability to display visual representations of data to increase understanding and interpretation of data. I used QSR NVivo11 as the CAQDAS for this study. NVivo11 is a software application that researchers use to code and analyze structured and unstructured (e.g., audio-visual files, text, and images) forms of data (Sotiriadou et al., 2014). I used NVivo11 for coding, themes, and classification of the data.

The degree of conceptualization is composed of the descriptions, interpretations, and theoretical coding. The theory scope is composed of the bounded context, a substantive focus, and formal concepts. A part of analyzing data is discovering and sorting themes and subthemes. A theme is a construct of the expressions found in texts, sounds, images, and objects (Taylor, Thorne, & Oliffe, 2015). A task of the researcher is

to organize the collected data into themes (Hickey, Reynolds, & McDonalds, 2015). Before coding of the data began, member checking occurred. I then identified relevant statements from the interview transcripts and organized them into categories by themes and subthemes (Hastings & Payne, 2013). After identifying the relevant themes, I converted them to text codes.

Hayes and Singer (2014) noted that triangulation was a condition of the application of two or more different measuring instruments or methods to analyze research findings There are multiple types of triangulation: data triangulation, investigator triangulation, theory triangulation, methodological triangulation, and environmental triangulation (Myers, 2013, Patton, 2015). R. Yin (2013) suggested that researchers collect data from diverse sources in a case study to recognize converging lines of inquiry. Triangulation enhances the transferability, dependability, and confirmability of data (R. Yin, 2013).

I used data triangulation. I conducted interviews with ICT managers from a state-level first response organization. I asked the participants during the interview session to volunteer internal or external documents or other electronic media that they believe relevant to this study (Shenton, 2004). In addition, I used data triangulation to demonstrate multiple sources of data ensures the reliability and validity of the emergent theory (Esteves, Ramos, Cavalho, 2002). I entered the documents into a Microsoft Excel spreadsheet and analyzed in conjunction with the interview data using NVivo11.

Triangulation of data sources was used to ensure an increased level of reliability, validity (Myers, 2013), and dependability (Patton, 2015). Data triangulation is the use of multiple types of data sources in the execution of collecting the data during the study to

improve validity (Guion, Diehl, & McDonald, 2014). Data collected can be from different sources. Investigator triangulation is the use of more than one investigator to analyze the data.

In the course of analyzing the data, negative or discrepant cases (Erickson, 2012), may be found. A negative case is data present in the data analysis that is counter to other data (Katz, 2015). Katz (2015) claimed that the researcher must change the case into an acceptable case by refining the explanation of the phenomenon. Discrepant cases are points in the data analysis that do not coincide with the rest of the data (Erickson, 2012). According to Katz (2015) and Erickson (2012), negative case and discrepant cases should be treated as an opportunity to gain additional insights, demonstrate thoroughness of the data analysis, and to modify the explanation. I did not encounter any discrepant cases during the conduct of this study.

Issues of Trustworthiness

I enhanced the trustworthiness by assuring the credibility, transferability, dependability, and confirmability of this study. Reliability is ensuring that documentation of every element of the study happens so that the study is consistent and is repeatable by future researchers (R. Yin, 2013). Validity refers to the quality of research (Donnelly & Trochim, 2007). Validity in qualitative research is concerned with internal and external validity. Internal validity is related to the credibility or the plausibility of the study (Merriam, 2009). External validity is related to transferability or applicability of this research to other situations. To make certain that I measure what I say I am, and that I am consistent, I employed four strategies to enhance trustworthiness: credibility, transferability, dependability, and confirmability (Jackson 2012).

Credibility

The first of four strategies I used to ensure the quality of this study is credibility. The definition of credibility is showing that the study is believable based on the point of view of the participant (Donnelly & Trochim, 2007). According to R. Yin (2013), a threat to credibility is bias. To reduce bias, which is a threat to credibility, the researcher must notice and mitigate bias in the execution of the study (Houghton et al., 2013).

To maintain credibility, I interviewed ICT managers from multiple state level first response agencies within the state of Hawaii to obtain data needed to answer the research questions. I established the credibility of this study by using member checking. Member checking is reviewing the interview transcript with the participants to gain their feedback on the accuracy of the transcript (Goldblatt, Karnieli-Miller, & Neumann, 2011; Kuckartz, 2014). In addition to member checking, I used triangulation to minimize the threats to credibility (Myers, 2013, Patton, 2015).

Transferability

The second of four strategies to ensure trustworthiness of this study is transferability. The definition of transferability is when researchers take responsibility to ensure that the results of the study can apply to other studies (Patton, 2015; Venkatesh, Brown, & Bala, 2013). A risk to transferability is the inability to generalize a study (Singleton et al., 2010). According to Myers (2013), a detriment of qualitative research can be the failure to generalize to a larger population. Qualitative research uses smaller sample sizes than do quantitative research; therefore, it is difficult for researchers to make inferences to the greater population (Myers, 2013).

In this study, I conducted interviews with disaster agency ICT managers from multiple types of emergency management organizations. The goal was to collect data in as much detail so as broad an audience as possible could form their perceptions from the data (Denzin, & Lincoln, 2011). ICT managers from the disaster response organizations provided the opportunity to gain detailed data based on a broad range of perspectives from multiple organizations. The data collected from this study might be helpful to other types of first response agencies and agencies from different geographic regions. However, transferability of the results of this study maybe limited as this was a single study.

Dependability

The third of the four strategies I used to ensure the trustworthiness of this study is dependability. Dependability is concerned with the researcher documenting the details of the study to ensure the maintenance of consistency throughout the study (Donnelly & Trochim, 2007). I maintained dependability by testing the interview questions and document review using the Delphi technique to gather the opinions of a panel of experts into a consensus on a real-world topic (Dalkey & Helmer, 1963). I selected a small group of experts to participate in the Delphi technique. I incorporated the recommendations and feedback from the experts.

Confirmability

The last of the four strategies I used to ensure the trustworthiness of this study is confirmability. The definition of confirmability is ensuring the corroboration by an objective third party of the results of the study (Venkatesh et al., 2013). A potential for bias exists when conducting interviews in any qualitative study (Paton, 2015). Potential

biases and limitations exist on validation, a chain of evidence, and rival explanation (R. Yin, 2013). I mitigated the risks of bias by training on designing guiding interview questions, conducting interviews, and using automated data analysis tools (R. Yin, 2013). I used CAQDAS to mitigate some of the risks of bias (Merriam, 2009). Finally, to combat the possibility of bias, I engaged in epoché and bracketing. I achieved epoché by not focusing on my opinions (Overgaard, 2015) about the factors that increase alignment between SMAC technologies and disaster response actions; instead, I concentrated on the experiences shared by the disaster agency ICT managers. Bracketing is a method to increase the quality of the research study by reducing the effect of the assumptions that a researcher may have about the topic (Tufford & Newman, 2012).

Ethical Procedures

The conduct of the investigation must follow ethical guidelines. According to Damianakis and Woodford (2012), the nature of qualitative studies creates ethical concerns because researchers must build a trusting relationship with the participants to collect data. To protect the participants, I followed ethical procedures as required by the American Psychological Association (2017) and Walden University. To manage the ethical concerns involving the recruitment and collection of data from the participants, I obtained their consent (Erickson, 2012; Kingori, 2013). I sent an invitation to participate (see Appendix D) to each prospective participant in person and by email. I introduced myself to establish my credentials and the basis for the conduct of this study to each potential participant. I followed-up with a consent form (see Appendix E), which informed the participants that their participation was voluntary, and they could withdraw at any time without penalty. All participant data were encoded into a secure format and

maintained per the guidelines listed in the consent form. Finally, I protected the participants' identities and privacy as stated in the confidentiality agreement (see Appendix E).

I obtained approval from the IRB before collecting any data. I obtained authorization to conduct the study from the organizations under study legal and management departments, and Walden University IRB. I ensured my Human Research Protections training from the National Institute of Health (NIH) is current. My current NIH certificate number is 2054099. I provided the participants in this study with a copy of the consent form, which provided contact information for Walden University and my contact details for information on their rights. I informed the potential participants that their participation is strictly voluntary, and they may withdraw without penalty at any time (Policy & Guidance, 2010). Should a participant had withdrawn from the study, any data collected received the same protections as all participants, and any data collected would not be a part of the study. Finally, the consent form included an explanation of the potential risks, benefits, and conflicts of interest.

The participants in this study provided thorough descriptions of their understanding of alignment between SMAC technologies and disaster response. One criterion for the participation of the participants is they be a full-time member of an emergency management agency within the state of Hawaii. The participants may hold a position within the disaster response agency that may connect back to information they may provide during the study. No identification of the participants was made in this study to ensure the ethical protection of the rights of the participants. Pseudonyms replaced their real names (Myers, 2013).

I advised the participants that I would protect their identities. The participants were asked to sign a confidentiality agreement. The confidentiality agreement outlined the procedures that I took to protect their identities. I did not include any personally identifiable information on the participants. I did not include the names and contact information in the results or the analysis section of this study. The names and contact information of the participants received the same protections as data collected from the study. I informed the participants that I would collect demographic information (i.e., age, income, education, and years on the job) (Merriam, 2009). I telephoned, or send an email to the participants thanking them for their time and efforts, along with information on how they can obtain a copy of the study if they chose to do so. I provided no incentives to the participants for their participation.

I kept all of the correspondence, document, data, forms, and applications on a password protected computer. I stored the recordings from the interviews on the original media, and I stored the rest of data collected on solid state drives (SSD), such as universal serial bus (USB) drives and external disk drives (Ritchie et al., 2013). I digitized, encrypted, and stored the data on primary and backup flash drives and DVD-R disks. I archived the solid-state drives and DVD-R disks in two separate but secure locations. The archive period will be 5 years. In addition, I digitized and stored the notes from the interviews in the same secure place as the SSD and DVR-R disks. After 5 years, the solid state drives and DVD-R disks will be destroyed by a professional document destruction service.

Summary

I presented in Chapter 3 the research design and methodology. Chapter 3 contained the research design and rationale, role of the researcher, methodology, issues of trustworthiness, and summary. The aim of this qualitative study is to explore what ICT managers know about aligning SMAC technologies with disaster response strategies. I identified my role as the researcher, and then I considered the research traditions before selecting a qualitative approach to this study. After choosing a qualitative approach, I described the research design and the procedures to answer the research questions thoroughly.

The study population were ICT managers from disaster response agencies in the state of Hawaii. The sample included 20 to 30 participants. Data collection consisted of semistructured interviews using open-ended questions, and document collection. Data analysis included coding the data into ideas, themes, and relationships using CAQDAS (Merriam, 2009). I took ethical measures to protect the participants and data collected from the participants (American Psychological Association, 2017). Finally, Chapter 4 provides the details of the process I used to collect the data and analyze the data by coding, categorizing, and organizing by themes.

Chapter 4: Results

This study was influenced by ICT managers from disaster response agencies lacking understanding of how to align SMAC technologies and disaster response strategies. The purpose of this qualitative grounded theory study was to explore emergency response ICT managers' understanding of how SMAC technologies are related to and can inform disaster response strategies. In this study, I focused on answering the primary research question and two sub research questions related to ICT manager's understanding of alignment between SMAC technologies and disaster response strategy. The overarching research question and the two subresearch questions were as follows:

RQ1: What is the level of understanding of alignment between SMAC technologies and disaster response strategies for ICT managers from disaster response agencies?

SQ1: How does the prevalence of SMAC technologies influence ICT managers' perspectives toward ICT initiatives and disaster management frameworks?

SQ2: How can exploring ICT managers' level of understanding of alignment between SMAC technologies and disaster response generate a new theory?

I used the Delphi technique to refine the interview protocol (Appendix A), interview questionnaire (Appendix B), and the document review matrix (Appendix C). Data collection involved collecting documentation and conducting semistructured interviews with nine participants. In conjunction with the interviews, the participants provided publically available documentation to support their perceptions. The data collected from the semistructured interviews and document review was analyzed using

NVivo11 to identify themes leading to a new framework organizing ICT manager's understanding of alignment between SMAC technologies and disaster response strategies. In Chapter 4, I begin with (a) research questions, (b) the pilot study, (c) research setting, (d) demographics, (e) data collection, (f) data analysis, (g), evidence of trustworthiness and (h) the findings organized by research questions, and (i) summary.

Pilot Study

Conducting a Delphi study assisted me to ensure the data collection instruments and the interview protocol were appropriate. According to Grisham (2009), Hsu and Sandford (2007), and Yousuf (2007), the Delphi technique is a qualitative method used by a panel of experts to anonymously reach a consensus on a complex topic (Skulmoski et al., 2007). In the case of this Delphi Study, a consensus was being sought on the interview protocol, interview questionnaire, and the document review matrix. The iterations in a Delphi study can range from three to five rounds (Delbecq, Van de Ven, & Gustafson, 1975; Ludwig, 1994), though three rounds are typically sufficient to attain consensus across responses (Brooks, 1979; Custer, Scarcella, & Stewart, 1999; Linstone & Turoff, 1975). After selection of a panel of experts, I conducted three rounds to refine the interview protocol, interview questionnaire, and document review matrix to their final stage. The experts from the Delphi study recommended changes such as dividing single questions into two questions to increase clarity. In addition, the experts suggested deleting questions inconsequential to answering the research questions to reduce interview time.

The panel of five members that were used to validate the interview questionnaire, interview protocol, document review matrix, and to test the interview procedures was selected from a list of professional colleagues. The experts were chosen for their professional experience as ICT managers for an agency responsible for responding to major disasters. The panelists met the following criteria list:

1. Are a present or past full-time member of a government agency at any level of government responsible for disaster response for 1 year or more.
2. Are responsible for providing ICT services to first responders and disaster response decision makers.
3. Have participated in at least one real-world disaster response event or training exercise designed to test interoperability between disaster response agencies.

The experts' participation in the Delphi study was voluntary. Each member of the panel was invited in person or by email. If the experts agreed to participate, they were presented a letter of consent. Each of the experts signed a letter of consent before being presented the interview questionnaire, the document review matrix, and being interviewed.

I developed two instruments to collect data for this study. The instruments I used were an interview questionnaire and a document review matrix. The experts were encouraged to provide expert feedback and recommendations on each of the interview questions. In addition, the participants were asked if the document review matrix would be sufficient to review the documents received from the main study participants.

I collected data from a single panel of experts. The Delphi Study took place over a 23-day period at a Department of Defense organization in the state of Hawaii responsible for providing and managing service members' ICT during large-scale contingencies including human-made and natural disasters. Four of the experts were employees of this organization. The fifth expert was a contractor working for the organization. I met with each of the experts in person and on the phone to review and provide comment on the interview protocol, interview questionnaire, and the document review matrix. I instructed the experts to indicate whether the interview protocol followed correct procedure, whether the questions were valid for answering the research questions, and if the headings of the document review matrix would add or take away from triangulating the data. The experts made notes on their copy of the documents, and I made notes on a separate copy of the documents as well as wrote notes in a journal.

After three rounds of the Delphi technique the experts had arrived at a consensus on the questions and categories. The Delphi study resulted in no changes to the interview protocol and only a few minor changes to the interview questionnaire and the document review matrix. The experts recommended that understanding would be increased if one of the questions was divided into two questions. It was suggested that I might delete two of questions as the interview questionnaire had too many questions to fit into an interview block of 30 to 45 minutes. The experts recommended edits to an interview question to increase alignment with the research question.

Once the Delphi Rounds were complete, I produced a table containing the feedback from the experts. The table was studied to identify patterns and inferences from the recommendations from the experts. I made all the changes recommended by the experts. Furthermore, I reorganized the interview questions to increase their congruence with the research questions. The analysis of the collected data showed a consensus about the usefulness of the interview questionnaire and the document review matrix. Based on the feedback from the Delphi Rounds I created the final interview questionnaire and document review matrix.

The experts who supported the Delphi study received the same protections as the participants in the main study. The experts who provided comments on the interview protocol, the interview questionnaire, and document review matrix were not identified in the Delphi study. The experts were asked to sign a consent form. The consent forms, documentation, and notes collected from the experts were digitized and stored on redundant USB drives. The manual documents and drive were stored in a locked file cabinet. The experts in the Delphi study had no participation in the main study.

Research Setting

ICT managers from multiple emergency management organizations were sampled to participate in this study. To answer the research questions in the main study, I sought to collect data from participants identified as ICT managers who are responsible for providing ICT to disaster response decision makers and first responders. I received approval from the Walden University IRB to use public methods to obtain contact information on potential participants. The participants in this study were selected using

publicly available resources (i.e., LinkedIn, Facebook, and departmental websites), and the population was chosen based on the selection criteria for this study.

The participants in the main study were from multiple disaster response agencies located in the state of Hawaii. The first organization was the central organization in the state of Hawaii responsible for coordinating the response to natural or human-made disasters. The second organization consists of United States military reservist who are activated during a major natural or human-made disaster. Both of emergency management organizations are led by the governor of Hawaii and in the event of a major disaster, synchronize their actions during a crisis.

The setting for each confidential interview was at a place of the participants choosing, via the telephone, or over virtual conferencing. I conducted eight of the interviews in person at the place of the participants choosing. I conducted one interview over the phone. I reviewed the informed consent form with each participant and provided a copy of the interview questions. The participants and I signed the consent form. I explained that the interviews would be recorded to transcribe later for the data analysis phase of the study. I asked if they were willing to be recorded and if that had any questions before starting the interview.

Demographics

The participants were from multiple emergency response agencies within the state of Hawaii. I purposefully identified the state of Hawaii as the region for this study based on a review of the current literature. The state of Hawaii is one of eight states in the United States with a high probability for an experiencing a major natural or human-made event (National Earthquake Hazards Reduction Program, 2015). Overall, my sample

included 25 individuals. In all, 15 individuals met the criteria for participation in the main study. I interviewed nine participants that accepted the invitation to participate in the main study. Five of the participants worked for disaster response organizations on the island of Oahu. The other four participants were from a state level military organization with the responsibility for assisting to the state of Hawaii in the event of a major natural or human-made disaster.

The participant demographics for the nine disaster response ICT managers from the state level disaster response agencies in the state of Hawaii are shown below (see Table 2). The participants functioned in various ICT roles within their respective organizations from directors, engineers, technicians, and planners. The number of years of experience the participants worked for their organizations averaged 9.5 years.

Table 2

Participant Demographics

Interview#	Organization	Primary Position	Years of Service
1	Hawaii Emergency Management Agency	Emergency Operations Planner	2
2	Hawaii Emergency Management Agency	Telecommunications Planner	3.5
3	Hawaii Department of Defense	Director of Command & Control & Computers	12
4	Hawaii National Guard	Director of Command & Control & Computers	1
5	Hawaii Emergency Management Agency	System Engineer	3.5
6	Hawaii Emergency Management Agency	Telecommunications Officer	25
7	Hawaii Emergency Management Agency	Deputy Telecommunications Officer	6
8	Hawaii Air National Guard	Network Technician	5
9	Hawaii Air National Guard	Network Technician	27
	Average years of service		9.5

Data Collection

Before collecting data, permission to collect data was granted by the Walden University IRB. The IRB approval number is 02-23-17-0113816 and it expires on February 22, 2018. The study included two data sources: (a) a document review matrix and (b) semistructured interviews. One hundred percent of the data were collected in the state of Hawaii from members of multiple emergency management agencies. The data collection period lasted 74 days, starting on 27 February 2017. During the first 23 days, a panel of experts using the Delphi Technique verified the correctness of the interview protocol, the understanding of the interview questionnaire, and document review matrix prior to me collecting data during the main study.

After completion of the Delphi Study, I used the following strategy to collect data: semistructured interviews and a document review. I used gatekeepers to obtain a list of potential participants who met the study criteria. After receiving the names, I contacted the participants by email and phone. I emailed or telephoned all the potential participants and explained the purpose of the research study.

I interviewed nine participants starting on March 21, 2017. I exchanged approximately 36 emails and 10 phone calls to coordinate the interviews. I interviewed eight in person and one by phone. Before beginning the interview, I provided the participant the informed consent letter and explained that the interview would be recorded, asked their permission to record, and provided a copy of the interview questions. The participants signed the consent letter, and I asked the participant if they had any questions before beginning the recording. At the end of the interview, I reiterated their protections and I them if they had any additional information to provide.

The participants in this study were difficult to reach. I used a convenience snowball sampling technique to facilitate contact with additional participants in the main study. At the end of the interviews, I asked the participants if they knew of any potential participants who met the criteria to participate in this study. If the participant suggested a potential participant I asked for their contact information or if they could ask the potential participant to contact me. If the potential participant was willing to participate, I set up the interview at the participant's convenience using the same procedures and protections. If the potential participant did not wish to participate in the study they received no further contact from me.

The Interview Guide in Table 1 includes an outline of the interview procedure to each of the participants before each interview. The participants were asked to reflect on their understanding of alignment between SMAC technologies and disaster response actions during an open-ended interview. The participants were asked 10 questions. All the participants were asked the same questions. I asked follow-up questions during the interviews. The follow-up questions differed across the interviews.

Most of the interviews lasted 30 to 45 minutes. One of the interviews lasted over 2 hours. Another interview lasted 1 hour and a half. I recorded all nine of the interviews using redundant digital recorders. In addition, I took notes in a journal for 100% of the interviews. All the interview recordings were then transcribed using a professional transcriber. The transcriptions took 31 days to complete. After each of the interviews, the transcripts were completed and returned to the participants by email for member checking. No edits were suggested by any of the participants.

I used a document review matrix to obtain secondary data from the participants. The publicly accessible documents consisted of eight types of documents ranging from department websites, personal websites, online documents, and articles recommended by the participants. I collected the documents and processed them using the document review matrix over a period of 42 days.

In summary, the data collected from the document review and semistructured interviews were transferred into NVivo11 for data analysis. As themes were identified and the theory begins the be revealed, no further sampling was needed to achieve saturation. Data saturation was met before I reached seven participants. All the manual documents collected and the participant's consent forms, journal notes, and transcripts were stored in individual folders on a redundant password protected USB thumb drives. Each participant was assigned a four-digit number to protect his or her identity and privacy. The manual documentation and USB drive were stored in a locked file cabinet. During the data collection phase of this study, I did not encounter any unusual circumstances.

Data Analysis

To answer the overarching research question and the two subresearch questions, data were collected and was analyzed from semistructured interviews and documentation. Purposive sampling techniques were used to find participants who met the criteria for participation. Interviews were conducted using an interview guide to answer the overarching research question and two subresearch questions. In addition, the participants were asked to provide documentation to support or reinforce what was discussed in the interviews.

The data were collected and transcribed within 24 to 48 hours. After member checking was completed, the interview data were entered into Qualitative Data Analysis Software (CAQDAS) to assist in the coding of the data. In addition, at the end of the data collection process, the documentation that was provided by each of the participants was entered in the CAQDAS for coding as well.

Open coding procedures was used to determine the categories (Charmaz, 1990). Codes were developed from each interview transcript. The interview transcripts were coded to answer the primary research question and the two sub research questions. The primary research question was what is the ICT managers' from disaster response agencies level of understanding of alignment between SMAC technologies and disaster response strategies? The first subresearch question was how does the prevalence of SMAC technologies influence ICT managers' perspectives toward ICT initiatives and disaster management frameworks? The second subresearch question was how can exploring ICT managers' level of understanding of alignment between SMAC technologies and disaster response generate a new theory?

From the initial analysis and coding, the word cloud of the top 100 codes that was developed from the document review and the semistructured interviews is shown below (see Figure 2).

Figure 2. Word cloud from the initial coding from the semistructured interviews.

Causes of failure, standardization, information sharing, seamlessness, integration, building relationships, and underdevelopment emerged as the themes for Research Question 1. The themes are arranged in order by the overall prevalence of theme. The data analysis indicated that causes of failure and standardization as important. One-hundred percent of the participants noted that causes of failure and standardization was important. Nine participants mentioned causes for interoperability failure. For example, Participant 4 stated, “Interoperability failures happen because disparate organizations do not train together under different conditions.” Participant 5 made a similar comment about interoperability failures, “If emergency response organizations are not trained to properly communicate in the format need and timely then interoperability failures occur.” Participant 1 and participant 3 reported that emergency management agencies in the state

of Hawaii follow the standard disaster response strategic frameworks as directed by the Department of Homeland Security. In addition, Participant1 and Participant 7 explained the software application that the disaster response agencies at the state level use to maintain situational awareness was standardized across all agencies.

Just over half of the participants reported that information sharing was important. Participant two defined information sharing as the ability to transmit operational information between agencies. Participant 8 explained, "information sharing, either through voice or data is critical to coordinating the actions of disaster response agencies." Similar to information sharing is seamlessness. Just under half of the participants though seamlessness was important. Participant 2 elaborated that seamlessness was being able to pass operational information between two agencies regardless of format, or type of system used.

Technical hesitation, framework, cloud connectivity, social media, social media monitoring, and training emerged as the themes for Sub-Research Question 2. The themes are arranged in order by the overall prevalence of theme. The data analysis indicated that technological hesitation, framework, and cloud connectivity are the leading themes. Seventy-eight percent of the participants noted that tech hesitation, framework, and cloud connectivity was important. Participants 1, 3, 4, and 5 expressed that they had little familiarity with social media or desire to operate during a disaster. Moreover, Participants 4, and 6 expressed that tools including social media present a security risk because the information may not be verifiable.

Analysis of the data showed that framework was as an important theme as technical hesitation. The data analysis revealed that the most experienced ICT managers were also trained in NIMS and ICS. Participants 1, 2, 3, and 4 had taken multiple courses in NIMS and ICS beyond the basic 100 level courses. In addition, Participant 5 stated, "Volunteers supporting the agency are required to takes the ICS course."

Clarity of technological landscape, convergence of technologies, and social media data analytics, convergence of information, and survivability emerged as the themes for Sub-Research Question 2. The themes are arranged in order by the overall prevalence of theme. The data analysis indicated that clarity of tech landscape, convergence of technologies, and social media are equally important. Seventy-eight percent of the participants noted that clarity of technical landscape, convergence of technologies, and social media was equally important.

About clarity of landscape, Participant 3 considered social media a great tool for communicating with the public. Participant 4 made similar comment that social media had a major role in disasters but only for notification purposes. The preponderance of the responses from the participants demonstrated they did not understand the potential of social media during future disasters. However, Participants 2 and 5 thought social media analytics would be a useful tool to gain insight from the volumes of social media.

The analysis of the data revealed interrelated themes. For example, the cloud computing and social media analytics are related themes. Participant 2 did not think social media analytics would be available anytime soon but thought that both cloud connectivity and social media analytics would be valuable. Similarly, within the convergence of technologies theme, Participant 7 viewed cloud computing as a valuable

way of maintaining connectivity during an emergency. The responses from Participants 1, 3, and 6 within the cloud computing echoed the comments made by Participant 7 within the convergence of technologies theme. They considered having redundant access to cloud-based systems critical to their operations. Another example was the standardization theme, and the framework themes were related. Almost all the participants mentioned NIMS and ICS within the standardization and framework themes.

Discrepant cases are points in the data analysis that do not coincide with the rest of the data (Erickson, 2012). I verified there were no discrepant cases, all the interview transcripts were returned to the participants for member checking. None of the participants asked for modifications to the interview transcripts.

Evidence of Trustworthiness

According to Cope (2014), the worth of the findings comes from the value of the research and maintaining clarity while conducting the study. I used four strategies to provide evidence of the trustworthiness of this study (Levitt, Motulsky, Wertz, Morrow, & Ponterotto, 2017). I met the criteria for trustworthiness by establishing credibility, transferability, dependability, and confirmability.

Credibility

The first of four strategies I used to ensure the quality of this study is credibility. Credibility is defined as the truth of the data collected from the participant and a true interpretation of all data collected regardless of the source by the researcher (Trochim & Donnelly, 2007). According to R. Yin (2013), a threat to credibility is bias. To reduce bias, the researcher must notice and mitigate bias in the execution of the study (Houghton et al., 2013). Two types of data were collected in the completion of this study: document

collection and semistructured interviews. After completing each interview, a copy of the transcript was returned to the interviewee for member checking.

To maintain credibility, I interviewed ICT managers from multiple state level first response agency within the state of Hawaii to obtain the data needed to answer the overarching research question and the two subresearch questions. I established the credibility of this study by using member checking. Member checking is reviewing the interview transcript with the participants to gain their feedback on the accuracy of the transcript (Goldblatt et al., 2011; Kuckartz, 2014).

Transferability

Transferability is defined as applying the findings from a study to other research setting or groups (Patton, 2015; Venkatesh et al., 2013). The findings from this study has merit for emergency management agencies in other states that have similar problems. For example, the seven other states that have a high probability of an occurrence of natural disasters might benefit from the finding from this study (National Earthquake Hazards Reduction Program, 2015). In addition, the findings from this study could be generalized to other types of emergency management agencies such as the Department of Defense (DoD), or the Department of Homeland Security. Agencies within the DoD and DHS are mandated to follow NIMS, and they use similar radio technologies as state and local first responders. Finally, to increase transferability, I used thick description which includes describing the participant's information collected in adequate detail that emotions of the reader of the reader might be provoked (Ponterotto, 2014).

Dependability

Dependability is defined as the maintaining consistency of data under similar research settings (Donnelly & Trochim, 2007). The possibility of bias exists in every study. I used data triangulation. I conducted interviews with ICT managers from a state-level first response organization. I asked the participants during the interview session to volunteer internal or external documents or other electronic media that they believed relevant to this study (Shenton, 2004). In addition, I used data triangulation to demonstrate multiple sources of data enhanced the rigor of the findings from this study (Esteves et al., 2002). I entered the documents into a Microsoft Excel spreadsheet and analyzed the documents in conjunction with the interview data using NVivo11.

Confirmability

Confirmability is defined as the ability of the researcher to prove the data collected from the participant does not contain biased information from the researcher (Venkatesh et al., 2013). For example, the research does not misinterpret the data collected from the participants. A potential for bias exists when conducting interviews in any qualitative study (Paton, 2015). I mitigated the risks of bias by training on designing guiding interview questions; testing the data collection instruments with experts using the Delphi technique, and using automated data analysis tools to analyze the data collected (R. Yin, 2013). I used CAQDAS to mitigate some of the risks of bias (Merriam, 2009).

Study Results

I used iterative analysis of the data collected from (a) interview questionnaire, and (b) documents collected from the nine participants to answer the overarching research question and the two sub research questions. CAQDAS was used to organize, compare

and analyze the data collected from the nine participants. The output from the data collected was formatted by theme and percentage of occurrence into tables for each research question. After analyzing the data collected from the semistructured interviews and the document review, I attempted to evaluate how the themes that emerged would answer the main research question and the two sub research questions. Below are the results relative to the overarching research question and the two sub research questions.

Results from the Overarching Research Question

The overarching research question was "What is the ICT managers' from disaster response agencies level of understanding of alignment between SMAC technologies and disaster response strategies?" The output from a query report helped identify the emerging themes within the overarching research question. The emerging themes and the percentage of participants whose transcript include the theme from overarching research question are shown below (see Table 3).

Table 3

Emerging Themes gathered from the Overarching Research Question

Theme	References
Causes of Failure	100%
Standardization	100%
Seamlessness	44%
Integration	33%
Building Relationships	22%
Information Sharing	56%
Underdevelopment	22%

Causes of failure, standardization, seamlessness, integration, building relationships, information sharing, and underdevelopment emerged as themes from answering the overarching research question. Causes of failure emerged as a significant

theme with 100% of the participants. Nine participants described a cause of failure. Participant 2 stated, “The key to failure is simply the inability to communicate, effectively communicate.” Participant 6 stated, “The problem we are running into these days more and more is this going to be on a encryption basis or non-encryption basis, and everybody wants….. well, we encrypt this, but we don’t encrypt that….that’s becoming one of the more prevalent issues of interoperability is how you deal with encryption.” Participant 9 statement is simular to participant 6’s statement. Participant 9 stated, “The different agencies being on the different frequencies is a big issue that we always run into.” Participant 7 stated, “Our number one directive from our commander or our director is zero loss of life. If you had a loss of life in a result of a communication failure, that is the ultimate loss right there. That’s the ultimate failure whether it could have been.”

Standardization also emerged as a significant theme with 100 percent of the participants. Participant 2 stated, “It’s designed, if you are familiar with the national NIMS system, it’s highly granular, you can load in as much or as little as you want. NIMS is the standard.” Participant 4, and 6 elaborated on standardization from the standpoint of personnel. Participant 4 stated “ The National Guard is kind of unique, in that really, it’s their main mission to work with other civil agencies out there. “The Adjutant General of Hawaii is not only commander of Hawaii National Guard, but he’s also the commander of the state of Hawaii’s civil defense too.” Participant 6 stated, “The Joint Coordination Group is kind of a state fed office that’s established once a disaster occurs and there would be periodic meetings of the incident commanders for each of the entities…you know, police, fire…basically those field response entities are plugging back

in to the Joint Coordination Center." However, Participant 8 stated, "As a whole really sharing information as far as disaster response agencies…we flow it up our chain of command up to our O-6."

Information sharing emerged as a theme gathered from the overarching research question with 56% of the participants. Participant 1 stated, "The key communication requirement is that all agencies are able to share situation awareness information, as far as what's going on in each county in each emergency operation center, managing the requests from the first responders up to the state, and from the state up to the federal government is required. Participant 3 elaborated, "We're much closer than we were during 9/11. I saw a picture, I forget where, the fire chief at 9/11 had six radios…FBI, Coast Guard, you know….". A simular comment was recieved from participant 4. Participant 4 stated, "Everybody bring something a little bit different light to the fight…whether it's the fire department, police department, the National Guard, your title 10, military forces whether it be active Army, Air Force, Navy."

Seamlessness emerged as a theme gathered from the overarching research question with 44% of the participants. Participant 1 stated," The information can flow up the chain without too many disruptions, without having to reinput new information as it flows up the command chain." While participant 1 statement focuses on the seamless flow of information between systems and people, participant 9's statement focused on technology. Participant 9 stated," Interoperability is having your COMM equipment operating on a seamless network or network meaning internet network type deal or seamless network where all your radios are on the same frequency."

Results from the Sub-Research Question 1

The sub research question one was "How does the prevalence of SMAC technologies influence ICT managers' perspectives toward ICT initiatives and disaster management frameworks?" The output from a query report helped identify the emerging themes within the overarching research question. The emerging themes and the percentage of participants whose transcript include the theme from subquestion one are shown below (see Table 4).

Table 4

Emerging Themes gathered from Sub-Research Question 1

Theme	References
Technological Hesitation	78%
Social Media	56%
Framework	78%
Cloud Connectivity	78%
Social Media Monitoring	44%
Training	22%

Technological hesitation, social media, framework, cloud connectivity, social media monitoring, and training emerged as themes from answering Sub-research Question 1. Technological hesitation emerged as a significant theme with 78% of the participants. Participant 1 elaborated that he had received training in social media for emergency management. However, he was hesitant to respond to the interview question because he stated, " I am still not clear what you mean by social media and how the emergency responders or managers can use the tool." Participant 3 was hesitant to elaborate on social media because social media was not the responsibility of the ICT

department. Participant 3 stated, “Social media, to me, it’s huge, although I did not get involved with it cause again it does not fall under me as a six.”

Framework and cloud connectivity also emerged as a significant theme with 78% of the participants. Although 100% were familiar with both NIMS or ICS. Almost 80% of participants commented on both NIMS and ICS. Participant 6 stated, “ICS is kind of the framework…it’s implemented at different levels.” Participant 7 made a simular comment. Participant 7 stated, “All of the ICS and the framework…the NIMS framework. It’s guidance and best practices…” Participants 4 and 8 commented on how links to cloud computing support mobility. Participant 4 stated, “Obviously, cloud computing has a mobile feature because, I mean, you can obviously access the cloud anywhere you’re at, right? In my mind when you talk about emergency communications for domestic operations, I think you have to have some kind of mobile capability.” Participant 8 stated, “As long as you’ve got some kind of social media available or cloud computing…something posted out for everyone to see if they’ve got connectivity, they’ll know exactly where to go…when to be there or if they’re going to be mobile, moving around, they know when to expect support.” Participant 5 stated, “We’re information gathering point. So, that’s why you mentioned the internet? We’re on the internet a lot….. for me, it’s mostly email…status emails…updates on WEBEOC, the main reporting platform that we log all the incidents and requests for information and requests for assistance…RFA’s and RFI’s.”

Social media emerged as a theme gathered from the overarching research question with 56% of the participants. Participant 1 commented on an experience during a disaster response. Participant 1 stated,” But the experience there was that a young man that does

surfing films shot some drone footage of the damage and posted it on YouTube and it completely changed our view of what was going on down on the Big Island. We really saw the visual damage of that place. It's amazing this kid prime footage, he turned this thing around in three hours. From video to post and that completely changed, certainly my view of how this stuff works and I think it changed everyone else's view. Participant 8 comment was simular to Particpant 1. Participant 8 stated, "Mobile data…of course you've got the Facebook…the Instagram…you know, a simple picture today, you might not realize what you got in the background but somebody else may take eyes on it."

Results from the Sub-Research Question 2

The Sub-Research Question 2 was "How can exploring ICT managers' level of understanding of alignment between SMAC technologies and disaster response generate a proposed new theory?" The output from a query report helped indentify the emerging themes within Sub-Question 2. The emerging themes and the percentage of participants whose transcript include the theme from subquestion one are shown below (see Table 5).

Table 5

Emerging Themes gathered from Sub-Research Question 2

Theme	References
Clarity of Technological Landscape	78%
Convergence of Information	56%
Convergence of Technologies	78%
Social Media Data Analytics	78%
Survivability	44%

Clarity of technological landscape, convergence of information, convergence of technologies, social media data analytics, and survivability emerged as the themes from answering Sub-Research Question 2. Clarity of technological, convergence of

technologies, and social media data analytics emerged as a significant themes with 78% of the participants.

Participant 4 stated, “better experts than me to figure out how you would employ something like that. Participant 2 commented on convergence of technologies. Participant 2 stated, “We have all these, look at our bands, we have…if you look at our code plugs, we have all these VTAC channels, I don’t think anybody knows how to use them. No one trains with radios very much.” Participant 7 stated, “Cloud-based stuff is good for redundancy but we need to have premise to a certain point. Because our demographics…geographical situation here…we get cut off, we get cut off.”

Participants provided their opinions on social media data analytics. Participant 5 stated, “You know, it may not be accurate…there’s some accuracy to it but in mass chaos…just the tone of the whole message coming through may dictate how that message is handled.” Participant 9 made a comment similar to participant 5. Participant 9 stated, “That’s a hard one because when you broadcast something people can blow it up…even if it is a positive impact.”

Convergence of information emerged as a theme with 56% of the participants. Participant 2 stated, “Social media and cloud computing, while they can be used in tandem, cloud computing changes your whole framework of where your computational machines are.” Conversely, Participant 5 stated, “There’s got to be a clearing house that looks at all these messages and says, “Where does this route to?” You have to sort and route those messages…all that information. So, how do you do it is a challenge.” Participant 7 stated, “There’s platforms out there or solutions out there that scan social media and scan all the different sources and you can find out maybe critical blackouts or

outages or road closures. There is a lot of stuff that people actually post on social media but what they should be doing is calling 911. Participant 8 stated, "Disaster recovery should really get on board with using social media or cloud tools because, as I said, it's available to everyone. You don't have to be locked into the networks."

The types of manual of electronic documents provided or recommended by the participants; the percentage of references per participant; the total number of references, and content of the documents are shown below (see Table 6).

Table 6

Document review

Document Type	Reference %	References	Content
Personal Website	22%	2	General Knowledge Share
City Website	11%	1	High-Level Information
Department Website	89%	8	High-Level Information
Twitter Home	22%	2	High-Level Tweets
County Website	11%	1	Emergency Preparedness Information
Communication Guide	22%	2	Optional Procedural Guide (2015,2016)
PowerPoint Slide	11%	1	Talking Points
Article	11%	1	Technology Overview (2011)

Analysis of the manual or electronic documents recommended or provided by the participants revealed that the 89% of the participants get their information on ICT from departmental websites. The departmental websites provided high-level information to their users. The next highest percentage was a much lower percentage at 22%. The documents included personal websites, social media, and communication guides. The resources provided general knowledge, Tweets, and procedural guides. Manual and

electronic documentation from other emergency management agencies at lower levels of government, presentations, and articles were referenced at a 50% lower percentage than the personal websites, Twitter, and communication guides from the Department of Homeland Security.

Several themes emerged from inductive analysis of the interview data and documentation from the participants demonstrated ICT managers understanding of alignment between SMAC technologies and disaster response strategy. According to Charmaz (1990), grounded theory researchers find themes in the data. By coding all of the interview transcripts and the documentation provided by the participants, the themes emerged. The leading themes arranged by research question are listed below (see Figure 3).

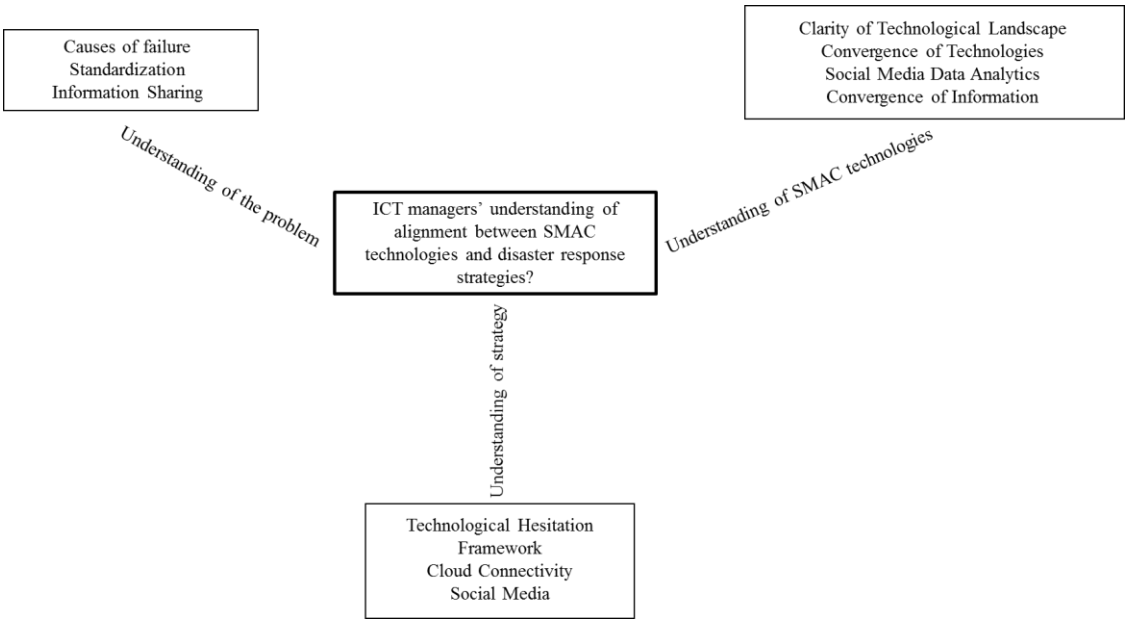

Figure 3. Leading themes arranged by research questions.

The participant's level of understanding of alignment between SMAC technologies and disaster response emerged from the themes identified during the data

analysis process. Causes of failure, standardization, information sharing emerged as the leading themes from the analysis of the data from the overarching research question. Technological hesitation, framework, cloud connectivity, and social media emerged as the leading themes from the analysis of the data from sub research question 2. Clarity of technological landscape, convergence of technologies, social media data analytics, and convergence of information emerged as the leading themes from the analysis of the data from Sub-Research Question 2. The effects of the findings are discussed in greater detail in Chapter 5.

Discrepant Cases

During the process of collecting and analyzing the data, discrepant cases are identified **(**Booth, Carroll, Ilott, Low, & Cooper, 2013). Discrepant cases are points in the data analysis that do not coincide with the rest of the data (Erickson, 2012). Responses from the study participants did not result in any discrepant case. Within 24 hours of receiving the transcribed interview, I emailed the interview transcript to the participant for their review. None of the participants who were interviewed for this study returned the interview transcript for modification.

Summary

In Chapter 4, before collecting the data in the main study, I tested my interview instrument and document review matrix by using a Delphi study. I presented in this chapter, the research setting and demographics of the main study, presented the data collection process and analyzed the data collected from documentation provided by the participants and semistructured interviews. Furthermore, I provided evidence of

trustworthiness by describing the measures taken to ensure credibility, transferability, dependability, and confirmability.

The goal of completing this study was to explore ICT managers from a disaster response agency in the state of Hawaii understanding of alignment between SMAC technologies and disaster response strategy. The results of this study are organized by the overarching research question and the two subresearch questions. Through the iterative process, causes of failure, and standardization emerged as the leading themes from answering the overarching research question. Technical hesitation, framework, cloud connectivity, and social media emerged as the leading themes from answering the sub research question 1. Clarity of technical landscape, convergence of technologies, social media data analytics and clarity of information emerged as the leading themes from answering the Sub-Research Question 2.

The leading themes that emerged from the findings were arranged into a framework. The framework provided visibility into ICT managers understanding of alignment between SMAC technologies and disaster response. The findings from the study demonstrated most of the ICT managers understood the current problems with interoperability between disaster response agencies ICT and disaster response strategy. An addition, most of the participants understood the potential and challenges of aligning SMAC technologies with disaster response. Moreover, the framework illustrated that ICT managers were congruent with the opinions on trust and training on SMAC technologies revealed in the literature review in Chapter 2.

The participants in this study felt the same way about social media and analytics. They were reluctant to use social media and the considered forms of analytics such as big data complex. Hence, expertise outside of the organization would be needed. What is missing from the framework speaks volumes about ICT manager's opinions. For example, very little was said about mobile devices in the previous literature on SMAC technologies by decision makers or first responder. The same is true for the participants in this study. Almost none of the participants in this study mentioned mobile in any form.

A difference from existing research on SMAC technologies emerged. The participants in this study recognized the potential of cloud computing. For example, the agencies involved in this study had more than one cloud based or enabled ICT solution to share information and ensure interoperability during a major disaster. The difference is the agencies the participants worked for considered connectively to the cloud critical to their response efforts rather than cloud computing itself.

In Chapter 5, I present an interpretation of the findings arranged by the overarching research question and the two sub research questions. Chapter 5 included a description of the SMAC technologies and disaster response framework. Also included in Chapter 5 is an explanation of the limitations of the study, and recommendations. Finally, I describe the implications and the conclusions from this study.

Chapter 5: Discussion, Conclusions, and Recommendations

The purpose of this qualitative grounded theory study was to explore information and communications technology managers' understanding of how social media, mobile, analytics, and cloud computing technologies (SMAC technologies) are related to and can inform disaster response strategies. Without a framework, emergency response agencies in the United States risk unintended additional deaths or wounded during a major natural or human-made disaster, which results in long-term impacts on the people affected by the catastrophe. The current alignment between ICT and disaster response strategies may leave first responders unable to cope with the increases in information based on the rise in intensity and frequency of future disasters (Comfort et al., 2012). The literature review revealed first responder's ICT is of little value during a major disaster because the ICT does not fit with actual emergency response strategy leading to ICT failures (Vogt, 2012; Vogt et al., 2011; Weyns & Höst, 2009). However, billions of dollars are being spent on ICT that conforms to legacy ICT needs and outmoded strategies (Goldstein, 2012).

The goal of this grounded theory study was to explore ICT managers from disaster management agencies in the state of Hawaii understanding of the alignment between SMAC technologies. The findings from the semistructured interviews and the document collection were used to answer the overarching research question and two sub research questions. The findings from conducting a grounded theory study resulted in a framework for aligning SMAC technologies with disaster response strategies. In Chapter 5, I present an interpretation of the findings, the limitations of the study, recommendations, implications, and conclusions.

Interpretation of Findings

Overarching Research Question

The overarching research question was "What is the ICT managers' from disaster response agencies level of understanding of alignment between SMAC technologies and disaster response strategies?" From the analysis of the data collected, I found multiple reasons for interoperability failures during major catastrophes. Disaster response required standardized practices and information sharing critical to the coordinating of the actions of multiple agencies during an emergency response effort. The responses from the participants demonstrated interoperability failures were caused by technical reasons or people-related reasons or a combination the two reasons. The participants provided technical causes such as incompatible hardware and features and social reasons such as the first responder's inability to communicate. In addition, one of the participants cited sociotechnical reasons for interoperability failure. A few of the participants understood that reducing interoperability failure was important because failures could result in loss of life.

The findings from the study were reflective of the peer-reviewed literature in Chapter 2: first response agencies experience interoperability failures because of incompatible hardware configurations (Comfort et al., 2012), first response organizations are not likely to trust information from another agency if they had not worked together before (Palttala et al., 2012), and interoperability failures occur because the choices in ICT the organization made determined how they prepped for disasters (Laakso & Palomäki, 2013). Moreover, first responder's ICT did not prepare them for nonroutine catastrophes.

The responses from the participants confirmed standardization was critical to disaster response. The majority of the participants adhered to the standardized disaster management frameworks mandated by the federal government. Other participants had a similar take on the frameworks in which they specified the flow of information during major disasters followed formal channels. The participants' comments were congruent with the literature review in Chapter 2. The majority of participants in the study considered the national incident management system (NIMS) and incident response system (ICS) highly useful. The ICS specifically mandates how multiple organizations form into a single temporary organization. In addition, ICS specifies who is in charge and how information is supposed to flow from the entities involved in the disaster to members of leadership (Jensen & Waugh, 2014).

The findings from the study revealed that information sharing was critical to the success of emergency management. More than half of the participants stated that information sharing was the key element to the execution of disaster response. More than one participant explicitly stated information sharing was highly encouraged between agencies and stakeholders. For example, information sharing was highly recommended between local hospitals and businesses with significant tourist traffic.

In Chapter 2, the literature review highlighted the need for sharing timely information during major disasters (Owen et al., 2013); however, the lack of timely information causes most information sharing problems during catastrophes (Palttala et al., 2012). Moreover, Scholl et al. (2012) found information sharing difficult because the shared information was not usable. For example, Laakso and Palomäki (2013) found that

different agencies used jargon, which led to unexpected problems understanding the information being shared.

The findings from answering the overarching research question indicated that 100% of participants understood the varied causes of interoperability failure. Furthermore, 100% of the participants agreed on the unpredictable nature of natural and human-made disasters, but they relied on following standards as the foundation of their actions. The majority of the participants comprehended the importance of information sharing, and their responses reflected their eagerness to share information during a crisis. The opinions of the participants were in alignment with the results of the literature review in Chapter 2. Subsequent research questions were answered by the participants' responses to the interview questions to described their understanding of alignment between SMAC technologies and disaster response.

Subresearch Question 1

Subresearch question one: How does the prevalence of SMAC technologies influence ICT managers' perspectives toward ICT initiatives and disaster management frameworks? The findings from the data analysis showed that technological hesitation, framework, cloud connectivity, and social media influenced ICT managers' perspectives. The responses from the participants on technological hesitation did not reveal any new information different than existing research. Many of the participants did not understand the application of elements of SMAC technologies in the context of disaster response. Some participants stated that elements of SMAC technologies were not the responsibility of the ICT department. The participants' organizations only interfaced with social media via the public affairs staff.

The responses from the participants on frameworks were not in alignment with the literature from Chapter 2. In chapter 2, the research findings indicated that members of first response organizations had significant problems with NIMS and ICS. However, the majority of participants were trained on NIMS and ICS. In addition, the majority of the participants had a high opinion of NIMS and ICS. The participants elaborated on their praise of frameworks such as NIMS and ICS. They recognized that NIMS and ICS were mature; however, in practice, they considered NIMS and ICS as tailorable strategies.

Jensen and Waugh (2014) explained that ICS was prevalent across disaster response organizations. In addition, when incidents did not fit, as in the case of a major event, the frameworks become less efficient. For example, during the initial phase of the disaster response, what is happening is unclear. Thus, first responders from multiple agencies are forming provisional organizations and inventing the response to the emergency as they go along (Allen et al., 2014; Ley et al., 2012; Vassiliou & Alberts, 2013).

The responses from the participants on cloud connectivity explained the power of converging SMAC technologies from the literature in Chapter 2 the best. The majority of the participants considered redundant abilities to connect to the cloud versus specific cloud computing services as critical. The majority of the participants felt cloud connectivity was a boost because the could connect to information from anywhere thereby increasing their mobility. In addition, the participants considered cloud connectivity important to the ability to share information with the widest group possible.

Dewan and Jen (2014) explained cloud computing was an enabler of mobility and sharing massive quantities of information. Cloud computing is also enabled by mobile users of devices able to collect large amounts of information anywhere anytime. In Zlateva et al.'s (2013) study on SMAC technologies and disaster response, cloud computing was the preferred tool. Cloud computing would enable first responders to respond to a catastrophe anywhere on earth.

The responses from the participants on social media showed approximately half of the participants understood the power that social media could exert on emergency management decision makers during a major emergency. The findings were in concert with the literature from Chapter 2, such as data collected via social media serving as an additional stream of information to support decision making (Palen et al., 2012), and crowdsourced data from linked users on social media and mobile being used to analyze problems (Estellés-Arolas & González-Ladrón-de-Guevara, 2012).

The findings from answering the subresearch question one indicated that the majority of the participants had a significant understanding of components of SMAC technologies. The participants knew how social media could bring unique insights to decision making and information sharing. However, the majority of the participants were hesitant about social media. Some claimed they did not understand social media or social media was not their functional area's responsibility. The majority of the participants were well-versed in NIMS and ICS. The participants recognized the flaws and knew how to adapt them when needed. The participants were positive about cloud computing despite not being cloud computing practitioners. The participants understood the advantages that cloud computing had given their organizations to respond to disasters.

Subresearch Question 2

Subresearch question two: How can exploring ICT managers' level of understanding of alignment between SMAC technologies and disaster response generate a new theory? The findings from the analysis of the data discovered clarity of technological landscape, convergence of technologies, social media data analytics, and convergence of information would not add to a new theory, but added to elements of a framework. The responses from the participants on the clarity of technological landscape were congruent with the finding from the literature review from Chapter 2. Bressler et al. (2012) showed that first responders did not understand the technologies. San Su et al. (2013) found in their survey that first responders were familiar with social media. However, Abbasi et al. (2012) found that emergency response agencies did not know how to capture and leverage social media technologies such as Twitter.

The responses from the participants on the convergence of technologies echoed the literature review in Chapter 2. The majority of the participants were positive about all aspects of SMAC technologies in the context of disaster response. The participants were mainly positive about connectivity to the cloud and cloud-based applications. From the results of the literature review, Palttala et al. (2012) reported that uniform decision making and coordination structures could improve communication among first response organizations. Rezaei et al. (2014) claimed that SMAC technologies could aid first responders' ability to interoperate between agencies and across jurisdictions during a major crisis. Zlateva et al. (2013) found that first response organizations preferred cloud as their SMAC technologies component of choice for disaster response.

Similarly, the responses from the participants on social media data analytics mirrored the comments from the literature review in Chapter 2. The majority of the participants elaborated on how information from the public could be misconstrued. Bressler et al., (2012) explained decision makers and first responders thought information from disaster victims would be inaccurate. Abbasi et al. (2012), Bressler et al. (2012), and San Su et al. (2013) argued that decision makers and first responders did not trust the technology or the users. Moreover, according to Bressler et al. (2012) and San Su et al. (2013), first responders could not take action on information supplied via social media without additional corroboration.

Despite the responses from the participants matching with so many findings in the literature review, participants' responses on the convergence of information departed from the literature review in Chapter 2. The participants filled in the gaps in the body of research, which consisted of responses from decision makers and first responders. More than half of the participants in this study thought SMAC technologies and existing technologies could coexist. A shift in mindset would be necessary more than changes in technology. In the literature review, Khan et al. (2015), Shelton (2013), and Tan et al. (2013) believed individual and organizational behaviors would be the highest hurdle for cloud computing. Thus, according to Chen et al. (2012), organizations were behind on adopting SMAC technologies. According to Laakso and Palomäki (2013), Laskey (2013), and San Su et al. (2013), decision makers and first responders anticipated the systems supporting SMAC technologies would become unreliable for their needs.

The findings from answering subresearch question two indicated ICT managers' perspectives on SMAC technologies were simular to disaster response decision makers and first responders. The participants recognized the high potential of SMAC technologies to improve the effectiveness of disaster response. Specifically, they understood the ability to improve gathering and sharing information. The participants had simular concerns that disaster response decision makers and first responders had according to the literature review. San Su et al. (2013) argued that outside experts would be necessary to leverage technologies such as big data and crowdsourcing. The participants in this study believed they would need additional training on analytics from experts. In addition, the participants in this study had simular perspectives on trusting data from the public as the decision makers and first responders from the literature review. The participants in this study thought social media data from the public would be misused by the public.

The participants in this study diverged from the literature review in some ways. About half of the participants explained that the responsibility of monitoring social media lay within another functional area outside of the ICT functional area. Social media was treated as a method of informing the public rather a way of two-way collaboration with the public. The participants in this study remarked that when social media was checked, it was to gauge reaction not to collaborate or coordinate jointly with the public. Hence, ICT managers were familiar with social media, but had no direct experience with using social media in conduct of their disaster response duties.

A framework that increases alignment between SMAC technologies and disaster response strategies emerged from the findings from this study. The framework described in this study may contribute to a future grounded theory of alignment between SMAC technologies and disaster response. According to Charmaz (1990), grounded theory researchers find themes in data. The findings from the participants on disaster management strategies in this study were similar to findings from existing research. A summary of the leading themes with examples of the findings from the study linked to the framework are shown below (see Table 7).

Table 7

Comparison of Themes and Findings with Link to Framework

Leading Themes from Study	Findings from Study	Link to Framework
Causes of failure, Standardization, and Seamlessness emerged as the leading themes from answering the overarching question.	The participants considered NIMS and ICS useful strategies counter to the literature review. The participants had various reasons why interoperability failure was an issue in congruence with the current literature.	Legacy ICT & Information, NIMS framework, ICS framework, First Responders, Agency, Risk of Interoperability Failure, Information, Legacy ICT, Technology & Information, Major Emergency, Structured Information
Technological hesitation, Framework, and Cloud Connectivity emerged as the leading themes from answering sub research question 1.	The participants considered SMAC technologies a game changer but did not find it useful for disaster response. The participants thought disaster victims might inflame an already tense situation.	Decision makers, ICT Managers, SMAC technologies, Technology & Information, Disaster victims, Volunteers, and Legacy ICT.
Clarity of Technological Landscape, Convergence of Technologies, and Social Media Data Analytics emerged as the leading themes from answering sub research question 2.	The participants in the study argued they did not have the expertise, outside experts on analytics and social media would be necessary	Converged ICT & Information, 3rd party experts, SMAC technologies, ICT managers, Unstructured Information, Speed and amount of information.

The themes that emerged from the findings of this study revealed that ICT managers had the same ethos about interoperability failures as disaster response decision makers and first responders. In addition, the participants had the same positive attitudes and hesitance toward SMAC technologies as did disaster response decision makers and first responders. The findings demonstrated the participants have recommendations for solutions. Moreover, the participants have taken action on employing solutions using components of SMAC technologies.

SMAC technologies are so pervasive that organizations shape their strategy outcomes on SMAC technologies. Before SMAC technologies, organizations formed a strategic goal, and they hoped that ICT would let them carry out that goal. As discovered in this study, the technology came along, and the strategy followed. This is no less important for public organizations including disaster response organizations. The participants indicated that connectivity to the cloud allowed them a near faultless ability to share information. In addition, connectivity to the cloud enabled them to respond faster to information requests, maintain situational awareness, and operate from distributed locations.

The participants' replies were constructive in understanding the nuances of disaster management frameworks and information sharing. The findings from the research demonstrated that elements of SMAC technologies were the reason for caution, while other elements were saluted. The participants made little mention of mobile, and they panned social media, but they had already implemented cloud computing in multiple ways. The replies from the participants indicated that cloud computing would allow them to survive the technical failures, which would prevent them from sharing information

during an emergency. The reasoning for this mindset toward cloud computing was because of the far away location and unique geography of the state of Hawaii. The existence of cloud computing may have enabled new and modified strategies for the state of Hawaii emergency management agencies.

The proposed SMAC technologies and disaster response framework as shown below (see Figure 4), explains how SMAC technologies align with disaster response frameworks to demonstrate the value of SMAC technologies to improve interoperability during a major disaster. The disaster response agencies in this study applied portions of SMAC technologies to improve their disaster response strategies increasing interoperability and information sharing. While the organizations studied were not wholly invested in SMAC technologies, the findings indicated positive outcomes could be achieved by converging the old and the new. ICT managers and experts would converge legacy communications technology with SMAC technologies. In addition, the participants' opinions meant that for disaster response organizations to achieve the best outcome they would also need to converge the different types of information. The structured data from first responders and decision makers would be combined with the unstructured information from disaster victims and volunteers.

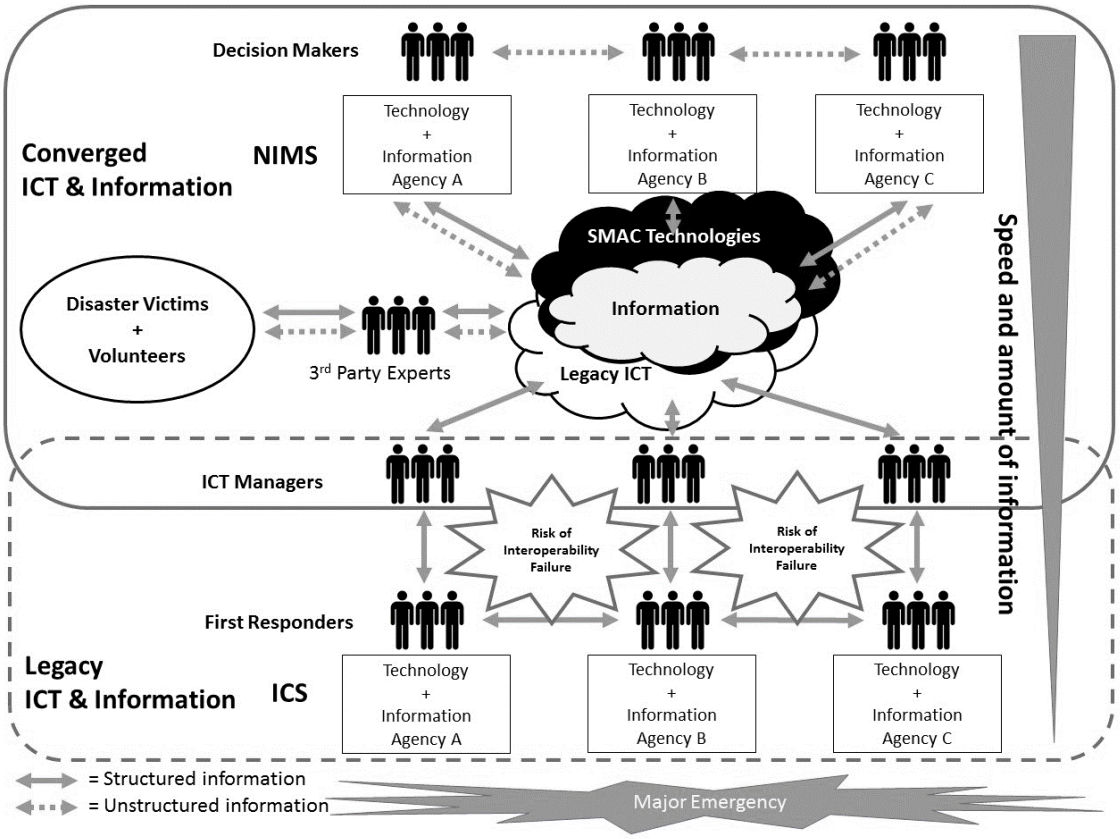

Figure 4. SMAC technologies and Disaster Response Framework

The SMAC technologies and disaster response framework has two major components. The first component integrates legacy information and communications technology (ICT) and information; the incident response system; and first responders. The second component integrates SMAC technologies and information; the national incident management system; disaster response decision makers, disaster victims, volunteers, and third-party experts. A component of both components is the ICT manager. The concepts that make up SMAC technologies and Disaster Response Framework are described below (see Table 8).

Table 8

SMAC technologies and Disaster Response Framework Descriptions

Label	Description
Decision Makers	Senior leaders of emergency management agencies who use enterprise level ICT to collect information from first responders and other disaster response agencies to aid decision making.
Information and Communication Technology Managers	Staff members of disaster response agencies responsible for providing the ICT infrastructure and furnishing ICT to decision makers and first responders.
Legacy Information and Communications technology	Current technologies used by emergency management agencies such as handheld radios.
Information	The data that is transmitted and received between members of emergency management agencies and disaster victims.
Incident Response System	Disaster response strategy designed to standardizes the coordination of actions of between multiple agencies at the incident level of a crisis.
National Incident Management System	Disaster response strategy designed to standardize the coordination the actions of federal agencies and states in the event of a major crisis.
First Responders	The members of public safety departments who respond to incidents in their specific roles such as police, fire, and medical.

table continues

Label	Description
Risk of interoperability failure	First responders using legacy radios are exposed to risks of technical failures or inability to share information because of incompatible radios, faulty infrastructure inadequate capacity, or lack of training during a crisis.
Disaster Victims	Private individuals directly affected by a natural or human-made disaster which can assist in his or her recovery or is recovered faster because of SMAC technologies.
Volunteers	Private individuals located anywhere on earth who can assist in a major crisis to disaster victims or emergency management agencies via SMAC technologies.
3rd Party Experts	Personnel who are either full-time members of emergency management agencies or volunteers. Develop, provide, and manage SMAC technologies and information from disaster victims and first responders in the aftermath of a major disaster. Mitigate the hesitation by decision makers, and first responders toward the SMAC technologies and users. Seamlessly increase the speed and volume of structured and unstructured information to decision makers for decision making.
Social media, Mobile, analytics, and Cloud computing Technologies	Social media platforms; mobile devices and applications; analytical systems and techniques; and cloud computing hardware and services converged into unique combinations to solve complex problems.
Structured data	Data in a simple form such as words or text that can be quickly organized. For example, first responder's radios only transmit and received voice or simple texts.

table continues

Label	Description
Unstructured data	Data in the form of photos or videos that are not easily organized. For example, disaster victims using SMAC technologies may transmit photos about a catastrophe, but it takes specialized software to organize the photos into a map.
Velocity and volume of Information	The speed and how much data can be transmitted between decision makers and first responders depending on their ICT capabilities.
Converged Information and Communications Technology and Information	Bridging SMAC technologies and legacy technologies in a unique way to increase interoperability by combining incompatible technologies. The flow of information between agencies and people is increased because the physical information paths are increased. Structured data and unstructured data are combined to provide greater insights for decision making.
Legacy Information and Communications Technology and Information	Existing ICT, infrastructure, and perspectives used by first responders and decision makers that increase the potential of interoperability failures and is incompatible with SMAC technologies and unstructured information.
Agency	The various emergency management agencies involved in the disaster response effort who are coordinating their actions between agencies.
Technology	The various types of ICT used at the different levels of the emergency management agency.

In the event of an emergency requires more than one disaster response agency, the response agencies are mandated to use the incident response system (ICS) to coordinate the actions of first responders across emergency management agencies. The literature review and the finding from the study show that first responders are at the present no willing to reliquesh their legacy ICT. First responders currently use handheld radios that

only exchange information via voice. The ICS provided a method of organizing first responders and work arounds have made radios interoperable, but during major disasters, first responders have to deviate from the ICS and information sharing fails because of ICT breakdowns.

When a major disaster is declared, the national incident management system (NIMS) is the disaster response framework mandated by the U.S. federal government to manage the conduct of the overall disaster response effort. A major disaster is an aggregate of incidents in a single geographic area or a single incident of a sufficient magnitude many people and infrastructure are negatively affected. At the head of each agency is the disaster response decision maker who gathers information from various sources and provides the results of the decisions to first responders. The findings from the study showed the decision makers from the study made use of SMAC technologies as a means of sharing information faster and promoting interoperability. The ICT managers are responsible for this advance in the usage of ICT.

The ICT manager is critical to the converance between legacy ICT and SMAC technologies and ensuring the unimpeded flow of information from first responders, decision makers, and disaster victims. The findings from the study illustrated that the way forward for organizations is to use legacy ICT at the lowest level, yet were amenable to SMAC technologies. Therefore, with assitance from experts in SMAC technologies to fill in the gaps in knowledge, SMAC technologies could improve disaster response outcomes.

Leaders from disaster response organization wanting to leverage SMAC technologies will have to rely on outside experts to overcome the technicial and social challenges. The third party expert shown above (see Figure 4), is an expert in some or all of SMAC technologies. For example, during a major catastrophe, a single expert such as data scientist would ensure the emergency agencies have the necessary big data or crowdsourcing technologies to gather and process the enormous streams of structured and unstructured data from disaster victims and volunteers. Multiple experts in SMAC technologies such as data scientists, cloud engineers, and mobile web developers could combine their expertise to influence disaster response decision makers, ICT managers, and first responders trust in SMAC technologies and data from disaster victims.

Demonstrated by the literature review, disaster victims can generate information that best information for disaster response decision makers. However, they are left out on the strategy. In the context of this study, the disaster victims are enabled by SMAC technologies to save their lives an the lives of others. Disaster victims will be able to provide information to the world on their plight supported by SMAC technologies. In addition, they aide in their rescue or returned to routine activities faster by disaster response forces aided by SMAC technologies.

In the SMAC technologies and disaster response framework, disaster response victims and volunteers are a full member of the strategy. The intent of this approach is that assumptions are replaced by real-time information from the victims corroborated by official responders. Hence, the need for training in SMAC technologies and developing trust is removed as it is in place as a part of the disaster response strategy from the initial response to escalation to a major disaster.

Limitations of the Study

A limitation is a factor that may be a weakness in the conduct of the study (Connelly, 2013). Three limitations arose during the conduct of this study. The first limitation of this study was the small sample size. I used a purposive sample of ICT managers from emergency management agencies at the state level in the state of Hawaii. Therefore, transferability may be a limitation. However, to overcome this limitation, a future study which focuses on additional states or international regions with larger emergency management agencies, should be studied.

A second limitation of this study was finding a sample of disaster agency ICT managers who had the necessary experience. One of the criterion for participant selection is that the sample of ICT managers should have participated in an annual disaster response exercise within the state of Hawaii (Cabucu, 2015). The addition of this criteria was necessary for the completion of this study because it was not likely the ICT managers would have real-world experience as an ICT manager during a disaster. Thus, expertise in a training exercise would serve as a realistic simulation contributing to disaster agency ICT managers' experiences about interoperability between agencies and disaster response strategy. I used a convenience snowballing technique to find additional participants to overcome this limitation.

I used a small, purposive sample of ICT managers from multiple disaster response agencies. I used semistructured interviewing techniques to recruit a sample of 20 to 30 ICT managers from multiple disaster response agencies within the state of Hawaii. The study did not include disaster agency ICT managers at the local, federal, or DoD level. In addition, I did not include disaster agency ICT managers from international disaster

response agencies. However, there is a gap in the literature regarding the present issue of the lack of interoperability between disaster agencies in the United States. I instead focused on an exploration of ICT managers' knowledge and experiences of aligning SMAC technologies and disaster response strategies. Therefore, transferability may be a limitation. Additional research may be required to overcome this limitation.

The third and last limitation, which might have influenced the trustworthiness of this study, was the researchers bias (R. Yin, 2013). I used an interview questionnaire developed by me to conduct the interviews. However, my personal and professional bias may have influenced the collection and analysis of the data. I took specific steps in the design of the study to increase the trustworthiness of data (R. Yin, 2013). Before using the questionnaire, I used the Delphi technique to gain consensus from a panel of experts to validate the interview protocol, interview questions and the document review matrix. After conducting each interview, I used member checking to ensure that data collected from the participants were the same as stated by the participants (Patton, 2015). In addition, I used bracketing to reduce the impact of assumptions I had about interoperability, disaster response frameworks, ICT initiatives, and SMAC technologies (Tufford & Newman, 2012).

Recommendations

According to the findings of this study, several themes emerged from answering the overarching research question and the two sub research Questions. The themes that emerged from the overarching research question were congruent with the literature review in Chapter 2. The themes that emerged from the Sub-Research question 1 also were closely aligned with the previous literature. The themes that emerged from the Sub-

Research Question 2 diverged from the literature review in Chapter 2. The participants in this study had the same opinions about training on SMAC technologies and trusting SMAC technologies. The participants too had positive feeling about cloud computing. However, where the participants in the study diverged is their agencies had implemented cloud computing. Also, they had positive opinions of the disaster response strategies.

The themes that arose from answering the research questions were surprising. The majority of the ICT managers were experts on the NIMS and ICS frameworks. The unique location of the state of Hawaii and the geography of the Island chain prompted the selection of technologies. This situation was featured in the majority of the participants being knowledgeable about cloud computing. Most surprising was the answers to sub research question 2, in which the participants could see the convergence of technology and information as beneficial to the emergency response effort and addressing existing problems. Although the findings from the study were promising, I have made four recommendations for further research.

One recommendation for further research includes expanding the study to the mainland United States of America. The state of Hawaii has unique geography (Federal Emergency Management Agency, 2014e). Thus, the state of Hawaii is one of eight states with a high likelihood of an earthquake occurring (National Earthquake Hazards Reduction Program, 2015). Further research could include the seven other states with a high probability of an earthquake, which are in the mainland United States of America.

States such as California, have a larger geographic area and population than does Hawaii. Hence, the assumption is California's emergency management agencies at the state level would be larger than is Hawaii's. The ICT management staff within the

emergency management agencies would be larger. Also, the state of California's interoperability needs, challenges and costs would be greater. Therefore, ICT managers might have different perspectives than did the ICT managers from the state of Hawaii.

The population of ICT managers and sample size would be larger in a state such as California. This would most likely exceed the resources of a single researcher trying to conduct semistructured interviews in person or over the phone. A potential study might necessitate answering the same research questions but with a different data collection method. A study of this size may need to administer using a quantitative electronic survey versus an interview questionnaire. However, the increased sample size would add to the granularity of the data analysis.

The second recommendation is to expand this study to supporting emergency management agencies at the county and local level. The definition of a major disaster is a nonroutine disaster, which overwhelms the resources of a single organization (Cabinet Office, 2012; Scholl et al., 2012). Interoperability during major disasters continues to be a problem because first responders' radios are not adaptable to the information sharing needs of first responders during a major catastrophe (Laakso & Palomäki, 2013). In addition, the participants in this study demonstrated little familiarity with the mandatory ICT initiatives. Only one participant was knowledgeable about the funding of the ICT used by disaster response agencies. Additional research could prove beneficial, as the majority of the funding for current and future ICT initiatives will go to county and local emergency management agencies. A study of this kind would be another opportunity to explore the value of ICT initiatives about disaster response strategies.

A third recommendation is to expand this study to compare disaster response ICT managers' understanding of alignment between SMAC technologies and disaster response strategies. The nearly 100,000 first response agencies (Gorcin, 2014) are dependent on ICT initiatives funded by the Department of Homeland Security (2014a). A quantitative study comparing ICT managers from different types of emergency management agencies understanding of alignment of SMAC technologies and disaster response strategies could quantitatively compare the gaps. The latest initiative designed to improve interoperability would cost more than all previous initiatives in the last decade combined (Moore, 2016; Peha, 2013). This initiative has many funding shortfalls and technical challenges. Increased awareness of where resources are missing could lessen the financial and technical deficits.

A fourth and final recommendation is to expand this study to explore citizen members of first response agencies understanding of alignment between SMAC technologies and disaster response strategies. In the conduct of this present study, it was discovered that some of citizen first responders were present in the state of Hawaii. The citizen first responders are tasked to serve their communities in the event of a disaster until the official first responders can arrive (Department of Emergency Management, 2017). In addition, the findings from the analysis of the data in this study and the literature review demonstrated that citizens are highly proficient in SMAC technologies. Therefore, the assumption is that the citizen first responders are highly capable of using SMAC technologies and understand the challenges of communicating during a catastrophe.

The purpose of this recommended study would be to understand the citizens with the training and experience with disaster response to share their perspectives. This study might be useful because the citizens would have the training, but they might not have the day-to-day experience as first responders. This alternative role would shape their perspectives toward SMAC technologies and disaster response strategies differently than full-time first responders. Exploring citizen first responders' perspectives might provide members of official first response organizations with a more realistic idea of how to address their concerns about disaster victims and SMAC technologies.

Implications

Implications for Positive Social Change

The purpose of this study was to explore emergency response ICT managers' understanding of how SMAC technologies are related to and can inform disaster response strategies. The findings from this study have several implications. The findings of this study could reduce the amount of suffering and loss of life by increasing the ability of first responders to interoperate during major disasters.

In the conduct of this study, a surprising fact emerged that the state of Hawaii was training civilians to be first responders during an emergency. The civilian first responder's role is to provide first response for their communities until official first responders could arrive (Department of Emergency Management, 2017). As demonstrated by previous research, in the era of SMAC technologies, the disaster victim armed with SMAC technologies could provide critical information as well as or if not better than official first responders (Sarcevic et al., 2012).

The participants in this study demonstrated they understood the promises and challenges of existing ICT, standardization, and information sharing during major disasters. In addition, they demonstrated they understood the promise of SMAC technologies, how frameworks shape information flow, and the limitations of both. The participants offered more than one solution to mitigate the negatives.

The results of this study could contribute to positive social change by disaster response decision makers, ICT managers, and first responders addressing their concerns directly with the communities they serve. The civilian first responders are also disaster victims in the aftermath of a disaster. The difference is that the victims have been empowered through training. It is their primary task to respond to their communities' survival needs until official help can arrive. In addition, disaster victims enabled by training and SMAC technologies can serve as an information sharing gateway between official first responders and the impacted community. Unconventional approaches might mitigate members of disaster response agencies lack of trust in SMAC technologies (Laakso & Palomäki, 2013; Laskey, 2013; San Su et al., 2013).

The findings from this study has implications for other disaster response organizations. An unchanging element to any disaster is the disaster victim. In this study, that disaster has reached significant proportions so organizations with even considerable U.S. government resources might be caused upon such as the federal government or the active duty military. The assumption is that federal agencies and the military at the lowest level also use radio based technology, but have some sort of network technologies at the decision making level. Moreover, the same assumptions could be made about training and trusting SMAC technologies and disaster victims. The implications are similar for

federal agencies that respond to major disasters in the U.S. mainland and for Department of Defense organization who may have to deploy to support disaster victims from other nations.

Implications for Theory

I explored ICT managers from disaster management agencies understanding of the alignment between SMAC technologies and disaster response strategies. Existing studies on alignment between ICT and disaster response actions took place in Europe and Australia (Vogt, 2012; Vogt et al., 2011; Weyns & Höst, 2009). The researchers argued that ICT managers had problems determining the value of advances in ICT on disaster response strategies. Hence, the inability of ICT managers to communicate the value of ICT (Vogt et al., 2011) and guarantee the value of ICT (Weyns & Höst, 2009) lead to failure.

The information gained from the findings in this study have the potential to assist future researchers who might want to conduct additional research on alignment between SMAC technologies and strategy within private and public organizations. In the era of SMAC technologies, organizational leaders are going to adopt new strategies at an accelerated pace because of the ever-changing nature of SMAC technologies. The framework could serve researchers conducting future studies on the role of SMAC technologies on addressing the gaps in alignment between ICT and strategy. Particularly, private and public organizations who are considering recent or emerging advances in ICT in reaction to competitive and complex environments. Future research supported by this framework could prompt the formation of strategies that improve communication between executive leaders and ICT leaders.

Implications for Practice

The findings from this study could prove significant for management practitioners. The study results revealed that ICT managers from disaster management agencies hold similar thoughts as disaster management decision makers and first responders from previous studies. In existing studies, the practitioners blamed interoperability failure on the incompatibility of technology (Comfort et al. (2012); problems sharing information (Kruke & Olsen, 2012; Ley et al., 2012; Oh, 2012); and faults in disaster management frameworks (Jensen & Waugh, 2014).

The participant's responses revealed similar understanding such as causes of interoperability failure, standard disaster management frameworks, and sharing information as the existing research. The participants' responses suggest their knowledge of the causes of failure, standardization, and information sharing was similar to disaster response decision makers and first responders. Therefore, managers may be able to contribute to the formation of policies that govern the application of SMAC technologies before and during a major disaster.

Second, the study results showed that ICT managers from the state level emergency management agencies in the state of Hawaii mostly agreed with the current body of research. In the existing research studies found that disaster response decision makers and first responders considered SMAC technologies had potential for improving numerous aspects of disaster response (Bressler et al., 2012; San Su et al., 2013). However, the overarching opinion of using SMAC technologies by decision makers and first responders was negative (Laakso & Palomäki, 2013; Laskey, 2013; San Su et al., 2013).

The literature review provided multiple definitions of NIMS and ICS. NIMS, and ICS are disaster response systems, which are part of a mandatory disaster response framework (FEMA, 2014b; Jensen & Waugh, 2014). The responses from the participants in this study suggest they were highly knowledgeable about NIMS and ICS. The participants in this study had an extensive level of training on disaster response strategies. The participants remarked NIMS and ICS were like a box of tools. In other words, "NIMS and ICS is a set of best practices."

The participant's responses during this study showed they had the same enthusiasm as well as the same distrust for SMAC technologies as the finding from previous research studies. Where the findings from this study diverged from existing studies is the practitioners were positive about NIMS and ICS. The participants' responses suggest that the additional training they had received shaped their experiences with NIMS and ICS. In addition, the participants revealed they made extensive use of cloud computing technologies.

The emergency management agencies in Hawaii are dependent on connectivity to the cloud to avoid interruptions in the flow of digital information during an emergency. The results from this study could positively contribute to shifting the paradigm about SMAC technologies by decision makers, ICT managers, and first responders from disaster management agencies. The participants in this study adopted a novel approach to using cloud computing. The location and unique geography of the state of Hawaii dictated the need for cloud computing. The method of cloud computing the ICT manager's agencies implemented perfectly matched the change in mindset that would be necessary to leverage the technical and strategic power of cloud computing (Browning,

2014). The responses from the participants reflected that cloud computing was a way of doing things rather than a just a set of technologies and connections.

The findings from this study could address the issues about training in SMAC technologies. ICT managers could use the findings from this study to modify existing training programs or create new training modules. New training modules might address disaster victims needs and the effects SMAC technologies will have on information sharing during a major catastrophe. Moreover, ICT managers with their knowledge of first responder's legacy ICT and disaster response strategies might serve as candidates to attend programs that develop disaster response experts in SMAC technologies.

Third, the study results showed that ICT managers from emergency management agencies in the state of Hawaii had generated knowledge to contribute to a new framework. In previous studies on SMAC technologies, it was not uncommon for the ICT staff to have holes in their knowledge similar to the gaps as organizational leaders and end users (Dyché, 2015; Shelton, 2013). One reason is practitioners cannot keep pace with the speed at which SMAC technologies have shifted the behaviors of people (Dyché, 2015). The participants in this study demonstrated through their responses that they too thought that SMAC technologies should be left to experts although they were the ICT staff for their respective organizations.

The findings from this study suggested that the old and new technologies should converge. The responses from the participants showed that in the aftermath of a disaster existing technologies and SMAC technologies had strengths and weaknesses. The weakness of one technology can be overcome with another technology. SMAC technologies have demonstrated that by combining related technologies, they become

stronger together (Shelton, 2013). This is critical as the existing technologies are not going away and neither are SMAC technologies.

The old and the new technologies should converge using the knowledge and expertise of ICT managers, disaster victims, volunteers and third party experts. In the findings in this study, the participants indicated that first responders still use radios, but the decision making is down mostly on email and the web. The insertion of SMAC technologies would depend on the third party expert to create the novel solutions that integrate legacy information systems with SMAC technologies. The problem is efforts will have to made to add opportunities for the experts to join emergency management agencies before or after a disaster.

The findings from the study demonstrated that more than technology should converge. A theme from the study that emerged was that ICT managers were receptive to converging the information transmitted from legacy ICT and SMAC technologies. The results of the study indicate that legacy information from official first responders should be merged with information from unofficial sources such as disaster victims using SMAC technologies. The results revealed that the participants knew of examples of citizens providing uncommon insights into the disaster situation. The findings from this study could positively contribute to the discussion on aligning SMAC technologies with disaster response actions. If ICT managers could provide their insights to leaders and first responder on the benefits of sharing information via converging legacy technologies and SMAC technologies.

The data coming from the individuals and agencies involved in the disaster will be unstructured and structured. This means the official first responders will communicate mostly by voice. The disaster victims will communicate in unstructured ways such as audio, pictures, and video. The convergence of information occurs in the metadata. If disaster response decision makers aided by experts can, for example corroborate the urgency of information from first responders by merging global positioning data from official first responders and disaster victims. Verification from two location sources can lead to knowledge creation when decision makers can be assured by an official source and aided by pictures and videos from disaster victims.

The findings from the study might prompt ICT manager in the future to address the lack of trust in SMAC technologies. The third-party experts recommended in the framework are not intended to replace the ICT managers within disaster response organizations. The ICT manager's role could be to develop strategic objectives, refine existing processes or create controls in consultation with external experts in SMAC technologies. ICT managers in future studies may improve upon the framework created in this study to provide more information on building first responders trust in SMAC technologies.

Finally, ICT managers from emergency management agencies in the state of Hawaii have had the opportunity to provide their perspectives on the alignment between SMAC technologies and disaster response strategies. Before I conducted this study, ICT managers from disaster response agencies from the state of Hawaii may have continued to be silent about their knowledge and experience. Specifically, ICT managers explored in this study may have stayed quiet about how advances in ICT can alter their agencies

disaster response strategies for the better in a time of crisis. ICT managers from other states may become aware of the information from this study and initiate their own projects that incorporate SMAC technologies in part or whole.

The literature review provided evidence of the capabilities provided by SMAC technologies. Never before though possible businesses now exist because of SMAC technologies (Dyché, 2015; Shelton, 2013; Turban et al., 2013). In addition, the earthquake in Haiti demonstrated the power of SMAC technologies as volunteers created applications and hardware in hours using SMAC technologies. Experts in SMAC technologies will be necessary to converge first responder's legacy ICT with SMAC technologies. At the first responder level, the convergence will most likely have to be invisible. Projects including FirstNet are bringing incremental advances to first responders ICT (Goldstein, 2012; Moore, 2016; Peha, 2013). A small improvement such as global positioning similar to smart phones could be integrated into first responder's radios. SMAC technologies applications at the decision maker level could use this data in a SMAC technologies application based on social media to semi or fully automate formation of radio nets reducing the potential of interoperability failures due to device feature incompatibility.

The examples of the success of SMAC technologies from business and disaster management is also propelled by a need. The by-product of SMAC technologies is data. SMAC technologies are enabling individuals to create extraordinary amounts of data at unthinkable speeds. In the immediate aftermath of a disaster, first responders and decision makers are generating more information than they are used to. Moreover, since this data is voice data, the majority of the data is not useful. Existing technologies can

record conversations. Converging SMAC technologies with legacy technologies could provide the necessary storage, analysis, and dissemination tools to playback this data and filter it in real-time.

Decision makers and first responders stated they did not trust the public to do the right thing when using social media during a disaster. ICT managers could lead the research and development efforts resulting new forms of ICT that mitigates the integrity of social media. Reducing the granularity of data could be useful for capturing the insights from disaster victims. For example, corroborating multiple types of data with data from disaster victims will require professionals who can understand the content of message may not matter, but where the message came from, and the time it was sent, may matter more. The implication is that technologies in use by official responders will have to be able to differentiate from thousands of different users a few miles away sending real information and computers thousands of miles away generating fake information.

Experts in SMAC technologies along with disaster response ICT managers who understand first responder's information sharing patterns will be needed to educate decision makers. Merging the streams of information into a seamless layer could shape the disaster response strategy during a crisis. In the future, the hardware and software lifecycle in going to force the hand of decision makers to adopt SMAC technologies. At some point, decision makers from disaster response organizations are going to task their staff to provide new views of information such as real-time photos with metadata generated by the disaster. ICT managers will have to overcome the technical and social constraints and deliver the tools decision makers require.

Conclusions

I used a qualitative grounded theory study to explore nine ICT managers' understanding of alignment between SMAC technologies and disaster response strategies. The findings from this study may add to the body of knowledge on the management of information systems that can lead to improved strategies that enhance the technology used by disaster response organizations. Furthermore, the findings from this study could add to the existing knowledge leading to improved strategies that advance information sharing and agility between disaster response agencies during a major emergency.

Sustaining alignment between ICT and business has been a problem for organizations for more than 30 years (Kappelman et al. 2014). Specifically, alignment between ICT and strategy persists as a challenge because communicating the value of ICT to the success of achieving and sustaining alignment is a problem (Becker et al. 2015). According to Vogt (2012), Vogt et al. (2011), and Weyns and Höst (2009), this problem is the same for ICT managers in public organizations such as disaster response organizations. The ICT managers from disaster response organizations are unable to communicate the value of ICT to leadership and first responders nor are they able to guarantee the value of ICT. The result, advances in ICT that could mitigate interoperability failure are ignored by decision makers and first responders.

Interoperability failure is a key concern for first response organizations during major emergencies (Drouglazet et al., 2014). In the current literature, the research findings highlighted several technical and social reasons for interoperability failures between disaster response organizations. Incompatibility between first responders' radios have led to repeated interoperability failures, which cause additional and unnecessary loss

of life (Brattberg, 2012; Kean & Hamilton, 2004; Oh, 2012). Additional research showed a lack of cooperation and trust was a much as responsible for interoperability failures as incompatible technology (Vassiliou & Alberts, 2013). Further research has indicated the solutions to the problem cost in the billions yet have proven ineffective because technology and disaster response strategies are incongruent (Goldstein, 2012; Moore, 2016; Peha, 2013). Research showed the SMAC technologies could ease the technical and social problems related to interoperability failure, but decision makers and first responders are not keen on using during a catastrophe. Gaps exist in ICT managers' understanding of SMAC technologies and disaster response strategies.

Three limitations appeared during the conduct of this study. Sample size was a limitation because I used a purposive sample of ICT managers. To overcome this limitation I recommend that additional studies in other locations and types of agencies be conducted. Participant experience was another limitation. I used a snowballing sampling technique to recruit additional participants that met the critieria for participation in this study. Bias was a limitation in conducting this study. I used the Delphi technique to overcome potential limitations in the design of the interview questionare and the document review matrix.

The findings from this research study may have serious implications for theory and practice. The completion of this study not only helped explore ICT managers from disaster management agencies' understanding of alignment between SMAC technologies and disaster response strategies but lead to the development of a framework. The framework addressed ICT managers conclusions that existing technologies such as first responders radios and new technologies including SMAC technologies will have to

coexist for the near future. Therefore, ICT managers and researchers may have to move forward with the formation of strategies that address the technical and social concerns of decision makers and first responders. In practice, ICT managers will play a role in the creation of policies, processes, and training programs to govern SMAC technologies. In addition, ICT managers may act as project managers, consulting with third-party experts as a part of research and development project.

Finally, the study findings have significance for emergency management agencies. The findings from this study might improve the ability of emergency management organizations to share information between agencies during major disasters because of the framework. The framework created in this study demonstrated how converging technologies and information could improve interoperability between emergency management agencies. Disaster victims enabled by SMAC technologies sharing information with official response agencies could have a psychological effect on both the responders and the disaster victims. The findings could lead to positive social change because first responders may be to get to areas of need faster and eliminate wasted effort because of erronous information. Disaster victims recover faster, by being able to directly observe the results of their actions because of the ability to connect with disaster responders and love ones faster.

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Appendix A. Interview Protocol

Pre-Interview Checklist

- Install fresh batteries and test digital recorder
- Obtain paper and pens for note taking
- Obtain several copies of confidentiality and informed consent form
- Obtain all written permissions from participating organizations
- Collect contact information including names and phone numbers

Overview Checklist

- Introduce self
- Introduce the research project and purpose of the research to the participant
- Explain the informed consent form
- Obtain the participant's signature on the consent form
- Explain the confidentiality form
- Provide the participant a copy of the interview questions
- Explain the need to record the interview
- Ask for permission to record the interview
- Inform the participant of the interview time of 40 minutes to 1 hour
- Ask if they have any questions before beginning the interview

Closing Checklist

- Thank the participant
- Do you have any questions?
- Was there anything they did not understand?

- Are you willing to review the transcript of the interview for accuracy and to ensure your answers are as you dictated?
- Are there other individuals you would recommend I interview and why?
- Remind the participant of their protections as a participant?
- Remind the participant to not to discuss the interview.

Appendix B. Interview Questionnaire

This questionnaire will be used to collect information from semistructured interviews with information and communications technology managers to support answering the research questions. The individual interviews provide data to answer the two research questions.

Interview methodology

Interviews will use a semistructured design. The interviews will contain a predetermined set of 14 questions. The predetermined questions will be the same for all participants. The interviews will be conducted at a private location of convenience to the participant.

Introductory Questions

- What emergency management organization are you from?
- Briefly, describe your primary position?
- How many years have you been in your position?
- Briefly describe your participation in a disaster response training exercise or a real-world disaster while in your current or previous position?

Interview Questions

The research questions follow.

RQ1: What is the level of understanding of alignment between SMAC technologies and disaster response strategies for ICT managers from disaster response agencies?

11. What is your definition of interoperability between disaster response agencies during a major emergency?

12. How would you describe interoperability failure between disaster response agencies during a major crisis?
13. Briefly, describe your organization's standard operating procedures for sharing information with external disaster response agencies during a major emergency?

SQ1: How does the prevalence of SMAC technologies influence ICT managers' perspectives toward ICT initiatives and disaster management frameworks?

14. Describe your professional experience with social media mobile analytics and cloud computing technologies?
15. Describe your experiences with emergency management organizations using social media mobile analytics and cloud computing technologies during a disaster response exercise or real-world event?
16. Describe your experience with disaster response frameworks (i.e. National Incident Response System and Incident Command System)?

SQ2: How can exploring ICT managers' level of understanding of alignment between SMAC technologies and disaster response generate a new theory?

17. What has been the impact of social media mobile analytics and cloud computing technologies on information and communications technology initiatives and disaster response frameworks?
18. Could you provide an example of how social media mobile analytics and cloud computing technologies could positively impact the quality and effectiveness of emergency management during major disasters?

19. What is your opinion of disaster response organizations using social media mobile analytics and cloud computing technologies to collaborate with disaster victims during a major disaster?
20. What additional printed or electronic documents, websites, blogs, or videos could you recommend providing supplementary information on what we discussed today?

Appendix C. Document Review Matrix

This template will be used to gather information from an examination of documents provided or suggested by the participants in the interviews. The data collected will be used to describe ICT managers understanding of alignment between SMAC technologies and disaster response.

1. Does the document outline relevant state, and federal regulations, laws, rules, executive orders, agreements, etc., that support improving interoperability between first response organizations?
2. Does the document have an organization chart?
3. How does the document incorporate interoperating or information sharing with populations affected by a major disaster?
4. If the documents support information sharing with populations affected by the major disaster, does it mention how information is shared and what types of information?
5. What are the tactics, techniques, and processes used to achieve a useful level of information between jurisdictions and agencies?
6. How do the documents support situational awareness and decision making at the incident area?
7. Does the document mention the application of social media, mobile, analytics, and cloud computing technologies?
8. What are the current or typical means of sharing information, decision making, and situational awareness across jurisdictions, and agencies?

9. How does the document mention how ICT support local, state, and federal disaster response strategies?
10. How is the document made available to the organization (i.e. manual, electronic, web page)?

Appendix D. Invitation to Participate

Hello,

My name is William Worthy and I am a doctoral candidate in the school of Management at Walden University. I am conducting a study to explore disaster response agency information and communications technology managers' understanding of alignment between social media, mobile, analytics, and cloud computing and disaster response strategies.

As an information and communications technology professional responsible for various aspects of managing information and communications technology for your agency, I am seeking your participation in this research study. I would appreciate 30 to 45 minutes of your time to participate in a one-on-one interview at a public location of your choosing.

Should you decide to participate in this research study, I will need to sign a consent form before conducting the interview. A copy of this form will be provided for your records.

Thank You,

William Worthy

Appendix E. Confidentiality Agreement

This confidentiality agreement form articulates the agreement made between William T. Worthy, the researcher, and [NAME OF INDIVIDUAL AND COMPANY OF A PROFESSIONAL TRANSCRIBER].

I understand and acknowledge that by transcribing the audio files provided to me by William T. Worthy, that I will be exposed to confidential information about the research study and the research participant. In providing transcription services, at no time will I real or discuss any of the information of which I have been exposed.

In addition, at no time will I maintain copies of the electronic or paper documents generated. Further, upon completing each transcription, I agree to provide the electronic and paper documents to the researcher:

William T. Worthy

I understand that breach of this agreement as described above could result in personal and professional harm to the research participants for which I will be held legally responsible.

Transcriptionist's Signature_____Date: _____

Researcher's Signature: _____Date: _____

Appendix F. Delphi Study Interview Questionnaire

This questionnaire will be used to collect information from semistructured interviews with experts in information and communications technology to validate the interview questions. The individual interviews provide data to answer the main research question and two subquestions.

Interview methodology

Interviews will use a semistructured design. The interviews will contain a predetermined set of 16 questions. The predetermined questions will be the same for all participants. The interviews will be conducted at a private location of convenience to the participant.

Introductory Questions

- What organization are you from?
- What is your position in the organization?
- How many years have you been in your current position?

Interview Questions

The research questions follow.

RQ1: What is the level of understanding of alignment between SMAC technologies and disaster response strategies for ICT managers from disaster response agencies?

- What are your perceptions of disaster response?
- Please explain your definition of a major disaster.
- Briefly describe your organization’s tactics, techniques, and procedures for information sharing during major disasters?

- How would you describe the similarities and differences between decision makers and first responder's information sharing during major disasters?
- What are perceptions of the problem of interoperability failure between first response agencies?

SQ1: How does the prevalence of SMAC technologies influence ICT managers' perspectives toward ICT initiatives and disaster management frameworks?

- Please briefly explain your organization's ICT planning process with decision makers and first responders before a disaster.
- How would you describe SMAC technologies using your words?
- What are the challenges you perceive using SMAC technologies to interoperate between agencies during major disasters?
- What has been the impact of SMAC technologies on ICT initiatives designed to improve interoperability?
- What has been the impact of SMAC technologies on disaster management frameworks?

SQ2: How can exploring ICT managers' level of understanding of alignment between SMAC technologies and disaster response generate a new theory?

- What is your understanding of alignment between ICT and strategy?
- What is your understanding of alignment SMAC technologies has changed the definition of alignment between ICT and business strategy?
- How do you view other members of your organization feelings about using SMAC technologies to interoperate during a major disaster?

- Please explain why you agree or disagree that interoperability failures could be reduced by the application of SMAC technologies
- Could you follow up and describe how you perceive using SMAC technologies to interoperate with disaster victims?
- Could you provide an example of where SMAC technologies could improve interoperability between disaster response agencies?

Appendix G. Delphi Study Invitation to Participate

Hello,

My name is William Worthy and I am a doctoral candidate in the school of Management at Walden University. I am conducting a study to explore disaster response agency information and communications technology managers' understanding of alignment between social media, mobile, analytics, and cloud computing and disaster response strategies.

As an expert in information and communications technology responsible for various aspects of managing information and communications technology for your agency, I am seeking your participation in a Delphi study. I would appreciate your review and feedback on the interview protocol, interview questionnaire and the document review matrix. In addition, I would appreciate 30 to 45 minutes of your time to participate in a one-on-one interview at a public location of your choosing.

Should you decide to participate in this Delphi study, I will need to sign a consent form before conducting the interview. A copy of this forms will be provided for your records.

Thank You,

William Worthy

Appendix H. Delphi study document Review Matrix

This template will be used to gather information from an examination of documents provided or suggested by the Delphi study participants during the interviews. The data collected will be used to validate the document review matrix.

1. Does the document outline relevant state, and federal regulations, laws, rules, executive orders, agreements, etc., that support improving interoperability between first response organizations?
2. Does the document have an organization chart?
3. How does the document incorporate interoperating or information sharing with populations affected by a major disaster?
4. If the documents support information sharing with populations affected by the major disaster, does it mention how information is shared and what types of information?
5. What are the tactics, techniques, and processes used to achieve a useful level of information between jurisdictions and agencies?
6. How do the documents support situational awareness and decision making at the incident area?
7. Does the document mention the application of social media, mobile, analytics, and cloud computing technologies?
8. What are the current or typical means of sharing information, decision making, and situational awareness across jurisdictions, and agencies?

9. How does the document mention how ICT support local, state, and federal disaster response strategies?
10. How is the document made available to the organization (i.e. manual, electronic, web page)?