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Strategies to Recover from Satellite Communication Failures

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This is to certify that the doctoral study by

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Walden University
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Abstract

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Diploma, Kwame Nkrumah University of Science & Technology, 1994

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Abstract

In natural and manmade disasters, inadequate strategies to recover from satellite communication (SATCOM) failures can affect the ability of humanitarian organizations to provide timely assistance to the affected populations. This single case study explored strategies used by network administrators (NAs) to recover from SATCOM failures in humanitarian operations. The study population were NAs in Asia, the Middle East, Central Africa, East Africa, and West Africa. Data were collected from semistructured interviews with 9 NAs and an analysis of network statistics for their locations. The resource-based view was used as the conceptual framework for the study. Using inductive analysis, 3 themes emerged from coding and triangulation: redundancy of equipment, knowledge transfer, and the use of spare parts to service the SATCOM infrastructure. The findings showed that the organization's use of knowledge, and collaboration among NAs and nontechnical staff improved the organization's ability to recover from SATCOM failures. The implication of this study for social change was the reduced cost of satellite services due to the efficient use of the bandwidth. These savings can be channeled into the purchase of vaccines, shelter, and the improvement in the quality of water and sanitation for displaced persons in humanitarian disasters, which improve the organization's delivery of humanitarian services to the affected populations in the disaster.

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Dedication

I dedicate this study to the glory of God who sustains me in all aspects of my life.

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Acknowledgments

I would like to thank my Chair Dr. Bob Duhainy, who provided guidance and encouragement during the study and helped it come to fruition. You were always available and provided brilliant advice when I was stuck in various portions of this journey. I would like to thank my committee member, Dr. Steven Case for his patience and direction to set me on the right course, especially at the onset of the study when I could not get my prospectus right. I would also like to thank my university research reviewer, Dr. Gary Griffith for taking the time to ensure that my study was of quality and without errors.

To my parents, Mr. and Mrs. Dodu Lomotey, you instilled the discipline of hard work and dedication in me which has been extremely instrumental in helping me achieve my career goals. To you, I say thank you. To my children, Leroy, Adriel, Gavril and Shavon, I hope this achievement will encourage you to reach for the stars and believe that with God, all things are possible. I now promise to make up for the quality times I have missed to help you in your hobbies, school work, and planning towards your future.

To my wife Cecilia, on my knees, I present this achievement to you. You are the one who suggested I take this program. You challenged me to work hard and provided emotional and physical support. You made incredible financial sacrifices and concurrently, kept the household running while I was engrossed in the program. In local parlance, I say “Ayekoo” and want you to know that all you have invested in me will bear fruit in ways that you cannot imagine. I love you.

Table of Contents

List of Tables

List of Figures

Section 1: Foundation of the Study

Background of the Problem

Terrestrial telecommunication networks are vulnerable to disasters due to natural or manmade causes (Bao, Habib, Tornatore, Martel, & Mukherjee, 2015). Because of this vulnerability, satellite communication (SATCOM) networks have proven to be a viable alternative since they are less affected by terrestrial disasters (Pecorella, Ronga, Chiti, Jayousi, & Franck, 2015). The use of SATCOMs can be considered one of the best practices in support of disaster preparedness and support ("Smart Sustainable Development Model," 2016). According to Sakano et al. (2016), SATCOMS can be used to cover large and isolated areas. According to the International Telecommunication Union Telecommunication Development Sector (ITU-D), in Mexico, SATCOMs are used in rural areas to support 30,000 communication links in addition to being used as a backup to terrestrial links (“Question 5/1: Telecommunications/ICTs for rural and remote areas,” 2017). However, in light of these uses, the implication is that the failure of a SATCOM network can have far-reaching damages to users, especially if the outage is prolonged.

Problem Statement

When there is a disaster, failures result in the inability to relay the assessed needs of the affected populations for assistance (Saab, Tapia, Maitland, Maldonado, & Tchouakeu, 2013). Even though satellites have backups in their payload to offset failures to ensure the continuity of communication services

(Stathakis, Danoy, Bouvry, Talbi, & Morelli, 2015), SATCOM failures can have debilitating global effects on communications (Lu, Zhao, Sun, & Li, 2014).

In 2015, the European Conference of Postal and Telecommunications Administrations (CEPT) recorded 325 incidents of interference affecting satellite-based services with 5,818 interfering incidents vanishing without a trace (CEPT, 2016). The general IT problem is that SATCOM failures affect disaster relief organizations that use SATCOM in their operations. The specific IT problem is that some NAs deployed for disaster relief operations lack strategies to recover from SATCOM failures.

Purpose Statement

The purpose of this qualitative single case study was to explore strategies used by NAs deployed for disaster relief operations to recover from SATCOM failures. The participants were NAs working in a large government institution who had been deployed for disaster relief operations in Asia, the Middle East, Central Africa, East Africa, and West Africa; and who also had strategies to recover from SATCOM failures. Implications for positive social change are the opportunities gained by humanitarian workers to (a) potentially to save lives when SATCOM is used in early warning systems and emergency response, where the aim is to communicate imminent dangers to the largest audience in a short timeframe, (b) the need of humanitarian workers to communicate to the donor community, the food, clothing, shelter, educational and medical needs of the affected population during a disaster, (c) utilize satellite news gathering which enables news broadcasts

to draw global attention to the need for material and financial assistance, and (d) the use of telemedicine to help physicians located remotely from the disaster, to diagnose ailments or recommend treatments of the victims in real time.

Nature of the Study

I chose a qualitative methodology for this study. The qualitative method enables the researcher to understand and interpret the actions of the target population (Peck & Mummery, 2017). It was appropriate for my study because I intended to understand the strategies adopted by the participants when they encounter SATCOM failures. A quantitive method is used to test a hypothesis and can have inferior descriptions of the characteristics of the subject (Scrutton & Beames, 2015). Therefore, I did not choose the quantitative method because it was not my intention to test a hypothesis, but rather to draw out concise descriptions of the problem and how to resolve it. The mixed methods design has qualitative components that provide a depth of understanding of the problem, and an exploratory quantitative method that uses statistical measurements (Morse & Cheek, 2014; Munroe, Curtis, Buckley, Lewis, & Atkins, 2017). However, the quantitative portion makes mixed methods unsuitable because it was not my intention to use statistical measurements, which were beyond the scope of this study.

I selected a case study design for this study. A case study is used to understand a problem and how the remedial actions adopted are effective in resolving the problem (Keutel, Michalik, & Richter, 2014). A case study was

appropriate for this study because intended to understand a problem and verify whether the corrective measures were efficient in resolving the problem. A phenomenological design is used to understand the lived experiences of the target population that experienced a phenomenon (Gentles, Charles, Ploeg, & McKibbon, 2015). However, it was not my intention to understand lived experiences, but rather to acquire an objective understanding of the strategies used to resolve a problem. Therefore, a phenomenological design was not suitable for this study. A narrative design entails the analysis of the personal experiences of the target population without testing ideas (Miller, 2017). It was not my intention to analyze personal experiences in isolation, but rather to analyze the experiences of participants against industry practices to resolve a problem, and consequently, a narrative design was unsuitable for this study. An ethnographic design is used to study the culture of a group through immersion in their environment (Cappellaro, 2017). However, I was not studying the cultural norms of the participants in their environments, so an ethnographic design was unsuitable for this study.

Research Question

I developed a research question to guide this study. The research question was: What strategies are used by NAs deployed for disaster relief operations to recover from SATCOM failures?

Interview Questions

I used semistructured interview questions to explore the phenomenon, with the aim of addressing the research question. These questions were:

1. What is the importance of SATCOM to your operations in disaster-relief operations?
2. What skills are required to recover from SATCOM failures?
3. What strategies do you use to recover from SATCOM failures?
4. What strategies worked best, and which were least helpful?
5. What are the obstacles to recovering from SATCOM failures?
6. What are your dependencies on other infrastructure or resources?
7. In your opinion, what different strategies would provide a better resolution than what you already use?
8. Would you like to add any other information to your strategies regarding recovery from SATCOM failures?

Theoretical or Conceptual Framework

The conceptual framework on which this study was based was the resource-based view (RBV). Resources can include, but are not limited to, managerial, engineering, research personnel, financial or marketing skills (Park, 2018; Penrose, 1955) The RBV is a concept that describes how the latent capabilities in a resource can be leveraged for growth, and a sustained competitive advantage in an organization (Penrose, 1955). The driving ideas behind RBV are (a) the value an organization places on an acquired resource, (b) the rareness of the resource, (c) the imperfect imitability of a resource, and (d) the substitutability of a resource (Barney, 1991). In identifying strategies to recover from SATCOM failures, this conceptual framework provided a lens through which to identify resources and

their value towards the recovery from a failure. Furthermore, it enabled an assessment whether these resources were rare, could be imitated or substituted with other kinds of resources available within the organization. Through the RBV, resources that met these criteria were considered as essential to the advancement of the strategies to recover from SATCOM failures

Definition of Terms

Availability: The probability that a network or device is available for use at any point in time (Lira, Tavares, Fernandes, & Maciel, 2015)

Broadband Wireless Access (BWA): BWA technologies provide high-speed communication access through wireless means to consumer and business markets ("Broadband Wireless Access," 2019).

C-Band Frequencies: The set of radio frequencies which includes the range 3400MHz to 4200MHz, and used widely used in fixed satellite service communication (Abdulrazak & Hameed, 2014).

Carrier Identification (CI): A system of placing uniquely identifying information in the transmissions of satellite earth stations to ensure that each earth station can be identified (Weerackody, 2016).

Ku-Band Frequencies: The set of frequencies from 11-14 GHz and used for satellite communication ("Question 5/1: Telecommunications/ICTs for rural and remote areas," 2017).

Level 3 Emergency: A classification by the United Nations which is activated in response to a high impact disaster which requires an international response (Petherick, 2015).

Redundancy: A way of improving the availability of a system by duplicating the active unit. The duplicated unit of the system could be active and carry traffic concurrently with the original unit, or the duplicated unit could be on standby to carry traffic when the original unit goes offline (Chen, Zhang, Zhao, & Zhou, 2017).

Resources: Relationships between stakeholders and various kinds of skills that are related to: managing an organization, engineering solutions, performing research, managing human resources, financial management, or marketing (Park, 2018).

Terrestrial Network: An integration of terrestrially placed telecommunication networks that can transmit and receive high volumes of information between each other (Wang, Xu, Zhang, & Zhang, 2017).

Very Small Aperture Terminal (VSAT): VSATs are earth stations that share satellite resources among many similar terminals ("Use of very small aperture terminals (VSATs)," 2013).

Assumptions, Limitations, and Delimitations

Assumptions

An assumption is used to support a position in a research process such that critiques are subject to some boundaries (Malterud, 2015). In my research, I made

a number of assumptions that facilitated the collection and analysis of the data. The participants had some knowledge of the maintenance and installation of VSAT systems to identify faults. The participants had experienced and recovered from any form of SATCOM failure. Such experiences of SATCOM failures enabled them to answer the interview questions objectively. Also, the participants were willing to participate and provided true answers to the questions, which helped to establish the validity of the research. Additionally, I assumed that I would have access to data showing the frequency the SATCOM failures occurred, the equipment inventory of spare parts for the VSATs, and supply chains that contributed to recovery strategies. Finally, I assumed I would reach data saturation for each participant when interviewing them.

Limitations

Researchers acknowledge limitations and describe the inherent weaknesses of their studies, which affords them the opportunity for future research on the same topic (Guise, Hansen, Lambert, & O'Brien, 2017). In this study, I was limited to a small sample of participants spread over countries in Africa and the Middle East. The sample size was further limited due to the lack of participation from some locations in the Middle East and Asia. For those that participated, even though there were similarities in their strategies, the participants may have tailored their strategies based on local infrastructure which may not be applicable to the participants in other locations. A second limitation was the possibility that the participants may have been biased by not revealing some challenges they were

experiencing to project their professionalism. A third limitation was that this study covered only C-band and Ku-band frequencies. A fourth limitation was that since this study was not an exhaustive review of all SATCOM failures, the results cannot be generalized to the SATCOM industry.

Delimitations

Delimitations are anticipated factors that can affect the interpretations of the results in a study (Sampson et al., 2014). The first delimitation was that the study was focused on participants working in Asia, the Middle East, Central Africa, East Africa, and West Africa. The second delimitation was the participants were IT NAs working in humanitarian organizations. The third delimitation was that the satellite earth stations were for the exclusive use of the humanitarian organization in locations that were providing humanitarian assistance to the victims in a disaster, and not for commercial activities. The fifth delimitation was that participants must have experienced some form of SATCOM failure or interference at their facilities. The sixth delimitation was that there were no more than three participants from any satellite earth station under study within each country.

Significance of the Study

Contribution to IT Practice

With data rates reaching more than eight terabits per day, there has been an exponential increase in the volume of data transmitted by satellites (Henniger, Seyfarth, & Diedrich, 2016). Satellite technology is used for early warning systems, global information and positioning systems, education, and emergency

response services (Pecorella et al., 2015). However, due to the broadcast nature of SATCOMs, it is prone to interference, and an incident on one satellite transponder can affect thousands of users (Ma, T., Lee, & Ma, M., 2013). The repercussions are evident when SATCOMs are used to save lives because it is used to coordinate disaster relief operations ("Smart Sustainable Development Model," 2016). Even though SATCOM service providers are making efforts to proactively prevent interference by using carrier identification, the current environment still requires that the subscribers work with the service provider to recover from the failure. Consequently, the findings of this study can contribute significantly to extant literature by providing different perspectives on the strategies that can be used to recover services quickly.

Implications for Social Change

In hard-to-reach areas, VSATs are used in telemedicine to conduct diagnosis, consultation, and even surgery (Kasturirangan & Joglekar, 2015). In manmade or natural disasters, terrestrial telecommunication infrastructure can get damaged, which leaves satellite communication as the most reliable medium to use. When VSATs are operational in disasters, positive social change can be achieved when they are used by the victims to communicate their needs of health, food, clothing, and shelter to the emergency authorities. The emergency authorities can use this information to focus the delivery of relief supplies to areas that are in dire need. Furthermore, the victims can also use this medium to inform their families of their wellbeing.

The benefits of uninterrupted communication are also evident when satellite networks are interconnected to terrestrial networks like cellular, microwave or fiber optic networks (space-terrestrial heterogeneous network). In such setups, communication that was limited to the coverage area of the terrestrial network is now extended over the satellite network to reach a larger audience (Choi & Joo, 2015). The uninterrupted communication opens an avenue for remote education for youth and adults, news broadcasts to enlighten the community on events affecting their wellbeing, security monitoring and briefings where the humanitarian organizations can discuss with local authorities issues relating to security that can protect the victims and humanitarian workers. SATCOM also supports positive social change when used as a backup to terrestrial telecommunication services. In the Central African Republic, the local telecommunication infrastructure was damaged during civil unrest in 2013 ("Question 5/2: Utilization of telecommunications/ICTs for disaster preparedness, mitigation and response," 2017), subsequently, SATCOM was established to coordinate the delivery of humanitarian assistance in hard-to-reach areas.

A Review of the Professional and Academic Literature

The purpose of this qualitative single case study was to explore strategies used by NAs deployed for disaster relief operations to recover from SATCOM failures. The participants were NAs working in large government institutions who had been deployed for disaster relief operations in the Middle East and Africa and had strategies to recover from SATCOM failures. The implications for positive

social change include (a) humanitarian organizations responding to natural or manmade disasters can potentially save lives when SATCOM is used in early warning systems to inform people in disaster hit areas of impending floods, civil unrest, wild fires and hurricanes. The aim is to communicate with the largest audience in a short timeframe, (b) humanitarian organizations in disaster-affected areas can communicate the assessed needs of the victims for medicine, food, clothing, shelter, education, and sanitation to the donor community for financial support, (c) satellite news gathering which can be used by humanitarian organizations to collate and broadcast the effects of the disaster which advocates for financial, and material support from the donor community, and (d) the use of telemedicine by humanitarian organizations to help remotely located physicians connect to personnel in the disaster area. Through this, the physicians will be able to visually diagnose ailments, or recommend treatments for people injured or sick because of the disaster.

This literature review was a combination of peer-reviewed academic journals and industrial articles taken from Thoreau Multi-Database Search, ProQuest Central, Science Direct, IEEE Xplore Digital Library, EBSCOHost, Association of Computing Machinery (ACM), and Google Scholar. I used the websites of government organizations and satellite operators to gather literature regarding current practices, reports, and remedial actions. The International Telecommunication Union (ITU) is a branch of the United Nations that works with countries to define telecommunication standards for interconnecting different

systems and technologies (About ITU, 2019). I used their website to acquire literature regarding the regulations, recommendations, and preventive measures to avoid satellite interference (SI) which also causes SATCOM failures. The CEPT was be used to gather reports regarding interference. Web sites of organizations that are at the forefront of SI mitigation efforts were also be accessed regarding current developments in this area. Some of these organizations were: The Global VSAT Forum (GVF), Satellite Interference Reduction Group (SIRG), World Broadcasting Union (WBU), and the United Nations Institute for Disarmament Research (UNIDIR).

Keywords used in searching for the appropriate literature were: *telecommunication/telecom failures, telecommunication/telecom disasters, satellite communication and interference, interference reports and statistics, disaster recovery, relief and communication, radio frequency interference, telecommunication threats, telecommunication recovery, radio threats, satellite communication threats, redundancy, WiMax,* and *reliability*. Additionally, I conducted searches using various permutations of these keywords to provide links and relationships that had a bearing on the study. These sources provided academic and industrial perspectives regarding recovery efforts for SATCOM failures. In Table 1, I have a summary of the frequencies and percentages of peer-reviewed articles.

Table 1

Details of Literature Reviewed by Year of Publication

	Older than 5 years	2014	2015	2016	2017	2018	2019	Total
Peer-reviewed articles	24	52	70	88	87	57	14	392
Non-peer-reviewed articles	6	2	7	2	3	0	0	20
Books	0	0	0	0	0	0	0	0
Web pages	0	0	0	0	0	0	2	2
Totals	30	54	77	90	90	57	16	414

There were three main parts of this literature review: (a) a synthesis of the conceptual framework, (b) synthesis and analysis of emerging themes from the literature, and (c) synthesis of previous work regarding recovery from telecommunication failures. I discussed the development of the conceptual framework and how it was applied in different areas of the humanitarian response. Some of these areas were: IT, strategic management, knowledge management, and innovation. Within the RBV framework, I also discussed how strategies were employed to recover from telecommunication failures.

RBV

The driving ideas behind this conceptual framework are the use of resources. Resources may be in the form of relationships between stakeholders, skills that are related to managing an organization, engineering solutions, performing research, managing personnel, financial management, or marketing products (Park, 2018; Penrose, 1955). Using the RBV, these resources can be grouped under the acronym VRIN where (a) V is the value an organization places on a resource to perform a function, (b) R is the rarity of the resource, in that, it cannot be easily obtained elsewhere, (c) I is whether the resource can be imitated, and (d) N is whether the resource is nonsubstitutable with alternative resources (Barney, 1991). When an organization finds a resource to be VRIN, that resource can be identified as providing a competitive advantage to its operations (Barney, 1991).

The RBV has been used as a tool to identify strategies and manage essential resources. Using the RBV in a study on how retailer-driven standards affected the governance of supply chains, Ghozzi, Soregaroli, Boccaletti, and Sauvée (2016) argued that even though the promotion of a product impacted sections of the supply chain differently, it increased coordination among the stakeholders. In effect, when developing a strategy to introduce a product, even though the organization experienced disruptions, their reliance on the resources they already controlled ensured the product met their standards. According to Barney (1986), when an organization is developing a strategy, they can obtain additional benefits if they

seek out additional capabilities in the resources they already control. Wernerfelt (1984) agreed that generally, resources obtained by an organization for a specific purpose could be used for different purposes. However, Wernerfelt pointed out that there were difficulties in identifying these resources. Furthermore, when these resources were to be used to develop strategies, there must be a balance between using the existing resources and introducing new resources.

The RBV provided a potential solution to obtaining the balance between the use of existing resources and introducing new resources. Kor and Mahoney (2004) posited that the RBV provided an environment for innovation and good management practices, and these had sufficient flexibility to be applicable in modern day strategic management. According to Kim, Hoskisson, and Lee (2015), organizations that evolve because of market differences may find out that they are unable to take advantage of abundant resources when compared to organizations that do not have similar resources at their disposal. The inability to take advantage of abundant resources can be explained by the fact that organizations that do not a have well-integrated business and IT operations could find themselves unable to adapt to rapidly changing demands for service (Aguilera-Caracuel, Aragón-Correa, Hurtado-Torres, & Rugman, 2012). However, over time, organizations can acquire internal capabilities and knowledge that can be used in other innovative areas not directly related to their core missions (Molina-Azorín, 2014).

Due to the variety of resources that could be required to put together a strategy to improve competitiveness, the RBV can be used in different situations.

Syssner and Meijer (2017) argued that all resources must be "relational, contextual and situational" (p. 464/616). While resources identified for use in the RBV can be internal (Lim, Wang, & Lee, 2017), external sources can be used depending on the context. For example, Kull, Mena, and Korschun (2016) argued that alliances between stakeholders and strategic marketers facilitate the exchange of knowledge to be competitive. Alliances can extend into industries such as IT service providers, supply chains and logistics (Park, Lee, Lee, & Koo, 2017). A sponsorship alliance can also play a similar role. According to Jensen, Cobbs, and Turner (2016), firms that allow sponsors to use their assets for marketing or commercial purposes, can increase their competitiveness.

A successful strategy to achieve a competitive advantage could hinge on the depth of skills and experience an organization has acquired over the years. The effective management of the human resource (HR) in an organization is required to retain the valuable skills used to obtain a competitive advantage (Özçelik, Aybas, & Uyargil, 2016). Retaining valuable skills in an organization considers managerial processes and social capital which involves interpersonal relationships (Pee & Kankanhalli, 2016). It is when managerial skills and social capital are linked to organizational goals, then the value of these resources can be realized (Backman, Verbeke, & Schulz, 2016). According to Pan, Pan, & Lim (2015), the RBV can provide a firm with directions regarding the value and limitations of their internal resources. In relation to this study, resources that cannot be imitated

(inimitable) and internal resources can be used in strategies to recover from SATCOM failures.

Nonprofit organizations and the RBV. The performance of nonprofit organizations can be analyzed through the RBV. Unlike for-profit organizations, any financial gains in nonprofits are reinvested into their missions (Arik, Clark, & Raffo, 2016). Nonprofit organizations are faced with a dilemma of maintaining their nonprofit values, and at the same time competing with other organizations in the provision of services (Helmig, Hinz, & Ingerfurth, 2015). In fact, nonprofit organizations experience the same challenges that for-profit organizations experience, where they must compete for beneficiaries, provide competitive pricing, and operate efficiently (Derrick-Mills, 2015). For example, Crump and Peter (2014) conducted a study of how non-profit organizations could reduce costs by sharing common services like IT, accounting, budgeting, project, and resource management. Out of 431 respondents (a) 52.8% of the respondents agreed that there was pressure from governments to reduce operating costs, (b) 50.3% of the respondents agreed that the donor community preferred donating to more cost-efficient organizations, and (c) 56.2% of the respondents agreed that sharing common services reduced their operating costs (Crump & Peter, 2014). However, drawing from an RBV perspective, this should not prevent them from making use of current technologies, innovating, and competing against for-profit organizations to strive for excellence, reliability, and efficiency.

Industrial firms and the RBV. The performance of IT in industrial firms can be analyzed through the lens of the RBV. An organization is a conglomeration of talents, skills, and resources that need to be controlled (Chun, 2016; Liao, Hu, & Ding, 2017). Furthermore, Wibowo and Handika (2017) argued that to be competitive, an organization must provide cost-effective services or have a distinctive product that is not available to its competitors. Their interpretation of RBV was that organizations acquire resources for the profit they can produce, with the expectation that these resources cannot be copied by competitors. Parallels can be drawn to the service industry where the acquired resources may not be expected to provide financial profit, but rather an efficiency in operations. Since there is no guarantee of profit, some firms consider the investment into IT as a risky venture, so they usually require a quick ROI (Jifeng, Ming, & Han, 2016). Within the framework of the RBV, there are risks to investment such as unforeseen costs, job loss, and fluctuating market conditions (Hoskisson, Gambeta, Green, & Li, 2018). However, Jifeng et al. (2016) argued that these investments could outweigh risks since IT resources can be used in other operational areas of the organization. Pan et al., (2015) suggested a three-step process for organizations to realize benefits of investments into IT, where (a) the IT assets must be used routinely for the purposes for which they were acquired, (b) the organization must be constantly seeking ways to improve the performance of the IT asset, which will ensure that the asset is still relevant to the organization, and (c) the organization identifies opportunities to improve their business processes, and modifies the IT asset to address the new

opportunity. Out of these steps, organizations can obtain an ROI and can be positioned to realize when an IT asset has outlived its usefulness and needs to be changed to suit current needs.

Innovation and the RBV. When organizations decide to collaborate to achieve a common goal, the RBV can be used to identify the resources that would make the partnership viable (Tsou, Cheng, & Hsu, 2015). However, the level of innovative practices depends on the resources that are available (Wernerfelt, 1984). The availability of these resources is consistent with the argument of De-Miguel-Molina, Hervás-Oliver, and Boix (2019), who argued that organizations with multiple assets and resources at their disposal are in a better position to develop innovative strategies than organizations that have fewer resources. Even though organizations can collaborate with each other to access additional resources that can contribute to their survival (Tsou et al., 2015), there must be adequate funding that would permit the testing of new strategies which could, in turn, drive the innovative practices (Parida & Örtqvist, 2015). In effect, when organizations decide to collaborate, there are a wider variety of VRIN resources to select from, which increases the chances of adopting innovative practices. For example, an organization that has extensive resources in IT services collaborating with an organization that has extensive resources in IT knowledge management, could potentially develop to develop innovative strategies to improve their IT services.

Governance and the RBV. The investment in IT products or services is not a guarantee for good performance (Uwizeyemungu, Raymond, Poba-Nzaou, &

St-Pierre (2018), and not every firm has all the capacity to excel in their products or services (Park et al., 2017). Teece (2017) pointed out that governance that only resulted in the efficient use of a fixed set of products and services was ordinary and did not provide a competitive advantage. However, a good governance structure for IT investments is a valuable asset which could result in the growth of a firm (Ali, Green, & Robb, 2015). Using the RBV, Ali et al., argued that this governance requires the involvement of company directors and senior management involved in the control of these IT investments. Over time, the tacit skills and knowledge that they acquire from controlling these investments can give the firm a sustained competitive advantage. Despite management having these tacit skills and knowledge, IT still requires a level of expertise to understand technical issues and to provide sound technical advice (Teece, 2017).

Organizations that want to leverage on the governance of their IT investments to exceed performance goals, and obtain a sustained competitive advantage, should have a mix of technical capability in their management boards. These capabilities can be acquired through learning about the product or service and transformation of internal organizational structures (Teece, 2017). According to El Meladi, Glavee-Geo, and Buvik (2018), agility is required to exceed performance goals. The implication is that an organization with the right mix of senior management successfully governing the IT investments may have achieved a level of agility. However, Mao, Liu, and Zhang (2015) argued that agility thrives in the presence of uncertainty. In effect, the uncertainty of the environment could

be considered a VRIN resource driving the capability to exceed performance goals. Nevertheless, if a firm commits to investing and managing its resources, it could potentially yield high returns and result in a competitive advantage to the firm (Seddon, 2014; Wernerfelt, 1984).

Dynamic capabilities theory. Rapidly changing environments can affect the ability of a firm to operate efficiently. The dynamic capability theory (DCT) is a framework that considers the ability of a firm to adjust its business strategy to match changing demands (McAdam, Humphreys, Galbraith, & Miller, 2017; Teece, 2014). Even though firms can acquire or discard resources to facilitate adaptability (Pan, G., Pan, S, & Lim, 2015), when the changing demands are met, new resources can be created which can provide the firm a competitive advantage compared to similar firms (Pan et al., 2015). The dynamism of a firm is driven by the ability to adapt to the changing needs of the business environment, where the changing needs can be sensed through partnerships with research institutions, professional organizations, customer and vendor relationships (Wilden & Gudergan, 2015). However, Wilden and Gudergan pointed out that frequent sensing for changes in a stable environment can negatively affect technology. In effect, the DCT provides a framework to adapt to dynamic business environments. However, the overall efficiency of a business can be negatively affected if the technology is frequently diverted to sense situations that are unlikely to occur when such technologies could be more productive in other business areas.

When applying the DCT in dynamic business environments, knowledge is produced which becomes a valuable asset. According to Zardini, Rossignoli, and Ricciardi (2016), dynamic organizations can go through learning cycles when adapting to changes; and with each learning cycle, there are deeper layers of knowledge acquired which cannot be replicated. However, an organization must have the capacity to absorb the changes if they are to take advantage of the benefits from the dynamic environment (Chowdhury & Quaddus, 2017). IT capacity can be increased when it is treated as a commodity which can be acquired with relative ease through purchasing, outsourcing or colocation of services (Beck, Pahlke, & Vykoukal, 2016; Zardini, Rossignoli, & Ricciardi, 2016). Since there may be some capital investment involved in increasing capacity, managerial oversight is required to identify and seize opportunities when they arise to enhance performance and obtain a ROI (Benitez, Ray, & Henseler, 2018). The impact of senior management cannot be overstated in dynamic capabilities. The agility of a firm to meet the demands of a dynamically changing environment requires that senior management make sound decisions to extend, create or modify the IT infrastructure; and such changes must closely follow the changes in the environment (Beck et al., 2016). These arguments suggest that, for a successful adaption to a dynamic environment, and identification of remedial strategies, senior management must be involved in all aspects of the change. Furthermore, given that IT has become intricately bound to business processes (Turulja & Bajgorić, 2016), the implications are that IT can be used to both sense changes, and strategize to accommodate changing needs.

The knowledge-based view (KBT) and the RBV. The knowledge-based theory (KBT) is an extension of the RBV and considers a firm as a storehouse of skills and knowledge that can be retrieved by the firm to give it a competitive advantage (Grant, 1996). These in-house specialist skills and knowledge require the coordination of the way people, processes and technology interact, and also ensures that the knowledge is correctly applied to the business area (Ferdinand, 2015). Even though knowledge is the differentiating factor between organizations, sustainable management practices are needed to ensure that the knowledge is retained in the organization (Hörisch, Johnson, & Schaltegger, 2014; Mahdi, Nassar, & Almsafir, 2019).

Organizations can acquire knowledge from external sources to complement their internal knowledge. Trantopoulos, von Krogh, Wallin, and Woerter (2017) indicated that the technology used to connect between the organization's internal network and multiple external sources of knowledge was a fundamental requirement to ensure that organization could access and utilize the knowledge. When knowledge is highly integrated into a team, innovation can be enhanced if there are task conflicts (Xie, Wang, & Luan, 2014). In a study of 59 student teams, Xie et al. indicated that conflicting tasks required teams to utilize the integrated knowledge at their disposal, and it was out of these resources that innovative outcomes were achieved. The key difference here was that, even though explicit knowledge was available, it was the implicit (tacit) knowledge and skills that created an advantage (Jeon, Dant, & Baker, 2016). Tacit knowledge is developed

out of interactions between different parties, and firms can obtain superior performance if they establish avenues for exchanging knowledge with external partners (Hung, Tsai, Lee, & Chau, 2015; Wang, Chang, & Shen, 2015).

The interaction of explicit and implicit knowledge can moderate the introduction of innovative solutions to tasks and business process. In an empirical study combining knowledge, technology, and innovative performance, Chen, Jiao, and Zhao (2016) argued that scientific knowledge had a significant positive relationship with innovation. Further revelations from this study were that, there was a reluctance to transfer scientific knowledge to other parties since it gave the owners a competitive advantage. Subsequently, firms that do not have such knowledge find it more advantageous to import it, which reduces the initial cost of implementation, and reflects as a talent exchange in the level of innovative performance (Chen et al., 2016; Low & Ho, 2016).

Practice-based view (PBV). Compared to the RBV that is used to identify resources which cannot be imitated, the PBV is used to identify specific techniques to a strategy that can be imitated, and provide a competitive advantage (Bromiley & Rau, 2014). Bromiley and Rau suggested that there were well-known practices like strategy formulation and influencing performance, which contributed significantly to the success of a firm. These practices were a conglomeration of the organizational structure, culture, material contexts, physical assets, and contributed to valuable knowledge (Bromiley & Rau, 2016; Fayard & Weeks, 2014). Hence, by matching a business goal with the resources needed, a firm can select from an

array of available practices to implement strategies to achieve that business goal. Nevertheless, firms must follow specific performance measurements to ensure that the adopted practices are not counterproductive to the performance of the firm (Treacy, Humphreys, McIvor, & Lo, 2019)

Environmental conditions can impose limitations on how the PBV can be applied. Jarzabkowski, Kaplan, Seidl, and Whittington (2015) argued that past, present and future practices were used as guidelines for identifying effective strategies. The implication is that, where these practices were not properly documented, there is a greater chance of identifying inappropriate strategies. Another limitation was identified in a study of technologically advanced companies in the industrial sector, where the relationship between practices and performance was inconclusive due to possible fluctuations in the local market (Fleury, M., Mauro, de, Oliveira, Mauerberg Junior, & Fleury, A., 2019). These diverse environmental influences imply that firms need to adopt multi-dimensional approaches to managing IT resources since they could be blind to their capabilities (Arvidsson, Holmström, & Lyytinen, 2014). These influences were consistent with Brito and Sauan (2016) who suggested that these outcomes could be a result of different practices and influences that were not within the control of the firm. Out of these arguments, it was apparent that the PBV can be used to determine the outcome or improve a process. However, there is no guaranteed success and the RBV presents a stronger front (Brito & Sauan, 2016). As argued by Camisón and Puig-Denia (2016), organizational and technical practices have the potential to

improve performance, but it is the process of learning these practices that improves the knowledge base of the firm.

Porter's five-force model (PFFM). A firm is can expand on its products and services if there are no competing alternatives to the products and services offered (Mathooko & Ogutu, 2015; Safa et al., 2015). PFFM considers five actions that influence the competitiveness of a firm which are (a) new entrants to an industry who offer similar products and services, (b) suppliers who can apply their bargaining power by virtue of the scarcity of their products, (c) customers who exert their bargaining power by virtue of the abundance of alternatives in the market, (d) the availability of substitutes to a suppliers products or services, and (e) the number of competitors in an industry (Porter, 1980). These forces may appear in a variety of forms which exert changes in the industry. For example, in a three-year study of the performance of manufacturing industries, Takata (2016) found out that the more the firm invested in marketing activities, the better was their performance.

However, the threats identified by PFFM can be turned into strengths by collaborating with competitors to pool or share resources (Guangdong, Qingshan, Jian-gang, Hamid Reza, & Wei, 2014). These strengths are consistent with a study of competition in non-governmental organizations (NGOs) using PFFM. Schwenger, Straub, and Borzillo (2014) argued that NGOs pooling their resources together for fund- raising activities could potentially increase the inflow of funds. Furthermore, they suggested that smaller NGOs should collaborate with their direct

competitors to improve efficiency. Comparatively, the RBV is complementary to PFFM, because the RBV can identify the resources that can make a firm excel above their competitors in a product or a service industry, while PFFM will identify the threats to excelling

Market-based view (MBV). Market forces can influence the ability of an organization that provides a product or service to perform better than its competitors. The tenets of the MBV are to understand the market forces that either propel or impede the efficiency of a firm and how they relate to human capital (Aghazadeh, 2015). Matoso and Abib (2016) provided three factors that influenced the efficiency of a firm. The strategies that contributed to the improvement in a firm, the resources the firm controlled and the competencies developed as a result of efforts to improve the firm's performance.

There are two approaches to the MBV, the attractiveness of products and services to a market, or the strength of the competitors offering similar products and services (Helm, Krinner, & Schmalfuß, 2014). The services and products from these seemingly opposing forces can be addressed through purchasing, manufacturing, or outsourcing them to another party. However, Yang, Xun, and He (2015) pointed out that in the IT industry, firms tend to maintain their core IT skills in-house and outsource complimentary skills. With this, they had instant access to address present and future needs. Even though firms might be expected to react in similar manners in response to similar market forces (Matoso & Abib, 2016), the differences in performance arise as a result of their inability to strategize and adapt

to these forces. Subsequently, a firm investing in knowledge and learning can perform more efficiently if its tacit and explicit knowledge is used to understand strategize and adapt to the market forces (Nadeem Ahmad & Usman, 2015).

To sustain a competitive lead in industry, firms are reluctant to share information with their competitors which is especially prevalent in environments where firms thrive on the acquisition of knowledge (Choy et al., 2014; Nadeem Ahmad & Usman, 2015). For example, while promptly informing customers of service related problems can indicate an efficient system, the reluctance to share the information related to the solution defeats the benefit of sharing knowledge (Choy et al., 2014; Wang et al., 2015). However, these decisions mean that the knowledge benefits are retained by the workforce because the extraordinary performance of a firm also depends on a high-quality workforce (Molloy & Barney, 2015). There are some exceptions, where for example, local firms in a global franchise depend on the knowledge of their partners to become competitive (Teece, 2017). In effect, firms that are hesitant to share their knowledge due to external market forces could potentially be missing out on the opportunity to improve their operational efficiency, despite of the fact that they have institutionalized tacit and explicit knowledge.

Capability-based view (CBV). The capability of a firm to perform competitively in an industry can be measured by the capability of its competitors. The CBV is used to understand and identify the capabilities of a system when going through transitions (Azevedo et al., 2015). However, at the heart of the CBV is the

identification of competition to spur development, where the strength of the relationship between a firm and its customers provides an avenue to know their competitors (Wu & Olk, 2014). Depending on the reasons these relationships are made, they could promote or hinder the potential benefits of knowing the strengths of a firm's competitors. For example, a concentration of exploratory alliances intended to increase time, asset and stock management, can have the contrary effect of reducing the capability of the alliance (El Shafeey & Trott, 2014; Lichtenthaler, 2016). However, a stable alliance can be established when the firms have internal knowledge management mechanisms to prevent the unauthorized knowledge transfer to competitors, which fosters innovation in the alliance (Estrada, Faems, & de Faria, P, 2016).

When evaluating the capabilities of a firm, Kamboj, Goyal, and Rahman (2015) identified two mediating factors, competitive advantage, and supply chain management. Even though a high investment in marketing improved financial performance, a focus on achieving a competitive advantage reduced the financial performance. Likewise, a focus on supply chain management also affected financial performance. A case study of technology conversion into processes, products, and services showed consistency with these elements. Here, as argued by Hamanaka Gusberti, Viegas, and Soares Echeveste, (2013), the capability must be considered in the context of a value chain which spans a firm's operations from conception to customer delivery. Out of these activities, intangible assets in the form of knowledge can be obtained that could be of benefit to the firm if there

were workable quality management processes in place (Arrighetti, Landini, & Lasagni, 2015). In effect, the CBV presents a framework that models the capability of a firm to perform a function in industry. Even though it has some processes that can identify the VRIN elements, the CBV is structured for a global overview of a firm instead of the focused approach that the RBV provides.

Strategies to recover from SATCOM failures

Telecommunications are essential for supporting disasters. While the recovery strategies must be well coordinated with redundancy techniques to reduce the impact of the loss in communication (Ramalakshmi & Radhakrishnan, 2014; Santhi & Sadasivam, 2015) the complexity of modern-day disasters has reduced the efficiency of backup resources for telecommunication failures (Bao, Tornatore, Martel, & Mukherjee, 2016). It is recommended that a recovery strategy should restore services in real-time and should be based on the demand for communication service (Miranda, Molinaro, & Razafindralambo, 2016). According to Bao et al., deploying telecommunications infrastructure after a failure can be more effective since it can be scaled to meet the exact demands of the users. These demands for telecommunication services are driven by the need for status reports, allocation of tasks, identification, and notification of risks, and defining procedures ("Satellite Earth Stations and Systems (SES)," 2015). In such scenarios, Kourogiorgas, Sakarellos, Kanellopoulos, and Panagopoulos (2014) suggested that one entity plays the lead role in managing the telecommunications infrastructure and complying with local laws. The benefits of this arrangement are avoiding the

repetition of tasks, and the sharing of resources which improves the efficiency of the response ("Question 5/2: Utilization of telecommunications/ICTs for disaster preparedness, mitigation and response," 2017).

Telecommunication networks are increasingly widespread, complicated, and require skilled engineers to rectify faults (Carrera, Iglesias, García-Algarra, & Kolarík, 2014). When disasters occur, there is a subsequent demand for high capacity telecommunication services (Sakano et al., 2016). Additionally, reporting multiple incidents for the same problem, or an incorrect description of the problem contribute to delays in recovering from a failure (Salah, Maciá-Fernández, Díaz-Verdejo, & Sánchez-Casado, 2016). According to Miranda et al., (2016), network congestion can occur as a result of competition between the victims and the emergency first responders for resources. However, this demand for services cannot be met without a technical understanding of the environment, which is required to develop strategies to cope with communication failures (Chang, McDaniels, Fox, Dhariwal, & Longstaff, 2014).

SATCOM equipment can perform in various states of degradation which reduces the capacity to support surge requirements for communication in a disaster, (Wilk-Jakubowski, 2018). When coupled with the high reliance on electricity and other telecommunication services, disruption has a ripple effect on other personal, social, and economic activities (Harrison & Williams, 2016). The implications are that network failures that result in recovery procedures are not only caused by failed components, but also by interdependencies between different infrastructure

(Chang et al., 2014). In effect, an evaluation of the availability and reliability of a network affords stakeholders the opportunity to address these deficiencies, and as a result, improve the recovery process (Lira, Tavares, Fernandes, & Maciel, 2015)

The integration of SATCOM and terrestrial networks provides alternative communication routes which introduce flexibility to the telecommunications infrastructure. Such integration results in a redundant architecture which is suitable for emergency and disaster relief operations and increases the reliability of the telecommunications infrastructure (Choi & Joo, 2015; "Question 5/1: Telecommunications/ICTs for rural and remote areas," 2017; Yeh & Fiondella, 2017). To a group of users or a particular service, some of these redundant architectures could be dedicated, shared or multiple backup links to a primary connection (Dikbiyik, Tornatore, & Mukherjee, 2015). Redundancy is also built into satellites. Tengyue, Bin, & Zhengquan (2014) describe a SATCOM environment where Internet Protocol (IP) switching is performed by the satellite to achieve redundancy. Redundancy is beneficial to telecommunication carriers by avoiding the isolation of persons or groups of persons that need to communicate with each other, and effecting rapid service recovery when there is a breakdown in the telecommunication infrastructure (Sakano et al., 2016)

Network and system modeling. The demand for unfettered access to information has influenced the development of telecommunication networks. According to Jahanshahi and Bistouni (2014), systems need to be functional in both routine and hostile situations. Over the years, network resilience has evolved from identifying

specific network architectural models to the need to access information, irrespective of the medium used, that is, satellite, terrestrial, or location (Rak, Papadimitriou, Niedermayer, & Romero, 2017). Access to information through such diversity requires an assurance that it is transmitted reliably within a network which can be verified through a reliability assessment (Ahmed, Hasan, Pervez, & Qadir, 2017). Given that robust and resilient networks are built to extend the life of a service and reduce economic loss (Baroud, Ramirez-Marquez, Barker, & Rocco, 2014; Tran, Domerçant, & Mavris, 2016), a reliability assessment can model the behavior of a system, detail the performance metrics, and provide an analysis of the techniques needed to recover services (Ahmed et al., 2017; Alsoghayer & Djemame, 2014). These models are in two classes, combinatorial and state-based. Combinatorial models examine the external structures that affect the reliability of a network, some of which include RBD, Fault Trees and Reliability Graphs (Sousa, Lins, Tavares, Cunha, & Maciel, 2015). State-based models examine the internal mechanisms of a device that affect its reliability, some of which include Stochastic Petri Nets (SPN), and Markov Chains (Sousa et al., 2015). Even though combinatorial and state-space models can be combined to represent complex systems (Matos, Araujo, Oliveira, Maciel, & Trivedi, 2015), comparatively, RBD models are more suitable to simplify large complex networks and analyze options (Ding, Wang, H., Kang, & Wang, K., 2014; Kumar, Kudinov, Bechta, Curnier, & Marques, 2015) and state-space models are more suitable for redundant systems due to the need to account for the time taken to change states (Sousa et al.). To

recover from failures and maintain connectivity, SATCOM networks have become integrated with terrestrial networks for redundancy (Kacimi & Pech, 2014). Space-terrestrial communication is an infrastructure where communication between different parties pass through satellites and land or sea telecommunication links. Space-terrestrial communications have become increasingly complex as a result of integration with mobile users, emergency responders and information relaying (Choi & Joo, 2015). Due to the complexity, determining the reliability of a redundant network can be performed using SPNs and RBDs (Borba & Tavares, 2017). Because there are multiple avenues to access a satellite network, reliability models provide an opportunity to understand the contributory factors of internal and external factors that affect the availability of the system. Knowledge of these factors can be used as strategies to recover from failures.

Reliability Block Diagram. RBDs are widely used to simplify systems (Bistouni & Jahanshahi, 2015). In a study to provide an algorithm to improve the allocation of virtual private networks (VPNs), the RBD was used to evaluate the dependability metrics that affected the decision-making process (Lira, Tavares, Fernandes, & Maciel, 2015). According to Bistouni and Jahanshahi, RBD models are in three modes, series, parallel, or k-out-of-n modes (series-parallel). In a series model, all elements must be functional to validate a service, and a parallel model validates a service even if one element is faulty. However, even though the availability of serial systems depends on the functionality of all components (Lira

et al., 2015), generally, the failures in a system cannot be eliminated (Okaro & Tao, 2016).

Figure 1. Hybrid Satellite-terrestrial Network

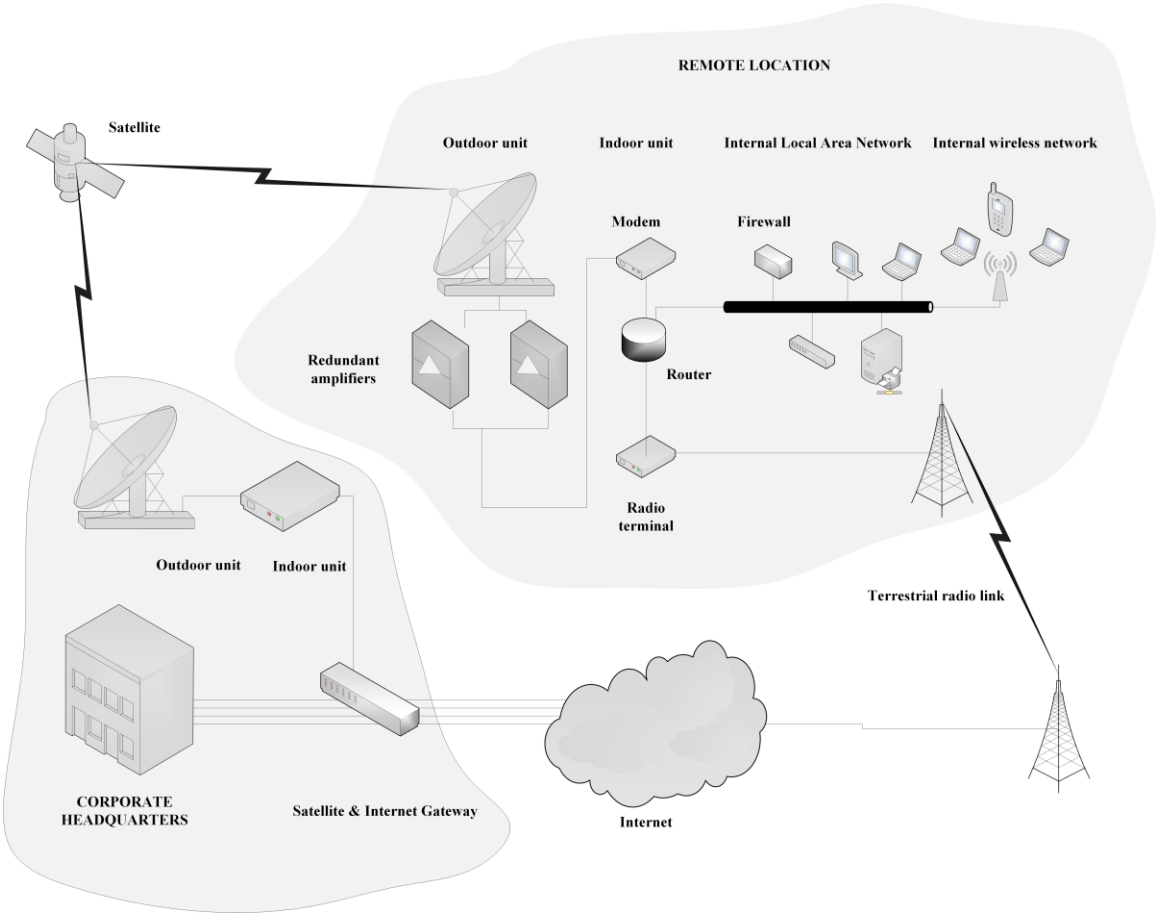

Figure 1. Hybrid satellite-terrestrial network. Adapted from "SDN/NFV-Enabled Satellite Communications Networks: Opportunities, Scenarios and Challenges" by

R. Ferrús, H. Koumaras, O. Sallent, G Agapiou, T. Rasheed, M. Kourtis, M. … T. Ahmed, , 2016, *Physical Communication, 18*, p. 95-112.

Using the network in Figure 1 as a basis, serial and parallel networks at the remote location are observed in the path over the satellite and the terrestrial radio link. Dâmaso, Rosa, and Maciel (2014) argued that an RBD model must have an input and an output from the source to a target destination. These inputs and outputs can be extrapolated from Figure 1 into the series-parallel RBD model shown in Figure 2.

Figure 2. RBD Model of a Hybrid Satellite-terrestrial Network

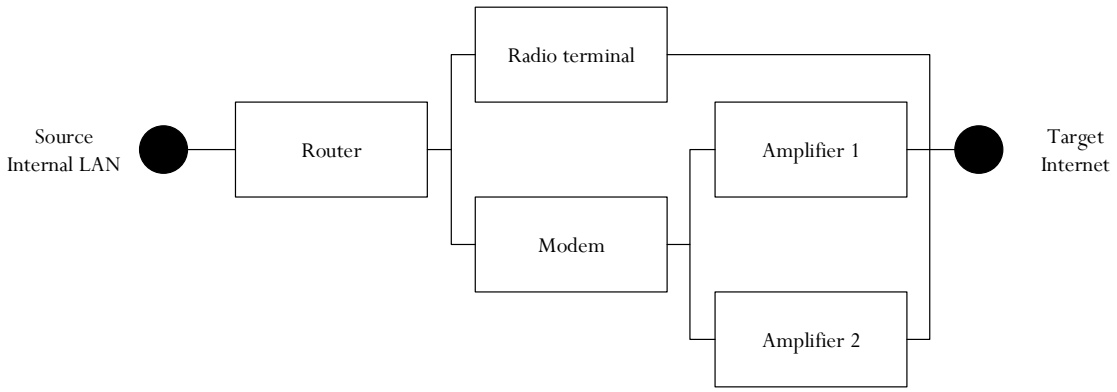

Figure 2. RBD model of a hybrid satellite-terrestrial network. Adapted from "Reliability of Wireless Sensor Networks," by A. Dâmaso, N. Rosa, and P. Maciel, 2014, *Sensors, 14*, p. 15760-15785.

The RBD model dictates that the reliability or availability of each element in a system must be ascertained (Lira, Tavares, Fernandes, & Maciel, 2015; Sousa et al., 2015). When this is determined, the reliability or availability can be

established for the whole system using the Availability and Reliability formulas. A, is the availability, MTTF is the mean time to failure and MTTR is the mean time to recover. R, represents the reliability, T represents the time to fail, t is anytime, and UA is the unavailability.

$$A = \frac{MTTF}{MTTF+MTTR}$$

$$R(t) = P\ (T \geq t)$$

$$MTTF = \int_0^\infty R(t)dt, \text{ (d) } UA = 1\text{-}A$$

$$MTTR = MTTF \times UA/A$$

Prior to establishing the systems reliability, Dâmaso, Rosa, and Maciel (2014) argued that the reliability of the parallel elements of such combinations must be calculated before that of the serial elements through these formulas for elements in parallel or hot standby. R(t) is the reliability of each block at a specified time, the first formula for the elements in series and the second formula for the elements in parallel, and n is the number of independent elements. In the RBD models, the identification of inputs and outputs to a system simplifies the analysis for the calculation of the availability and reliability:

$$R(t) = 1 - \prod_{i=1}^{n} (1 - Ri(t))$$

$$R(t) = \prod_{i=1}^{n} Ri(t)$$

Stochastic Petri net (SPN). The availability and reliability of networks need to factor the time taken to change states from operational to standby and vice versa.

Petri nets are useful in modeling dynamic environments graphically and the different states of a system (Ding, Wang, Jiang, & Xu, 2017; Koriem, Tarrad, & Farahat, 2014). Some state-space models that can accomplish this are the Markov chains and Stochastic petri nets (Šnipas, Radziukynas, & Valakevičius, 2018). These dynamic behaviors can appear in the form of inherent imperfections and partial functionality as argued by Kleyner and Volovoi (2010) who proposed two frameworks to achieve redundancy. One framework superimposes two separate networks on each other with no backup, so a failure in either network does not affect traffic. In the second framework, Li, Yu, and Bin (2015) proposed one network with multiple nodes to access the network, where each node is a backup to the other. Based on the use of hybrid satellite-terrestrial networks opined by Ferrús et al. (2016), each framework can be juxtaposed as shown in Figures 3 and 4 below.

Figure 3. Redundant Satellite Earth Station Without Backup

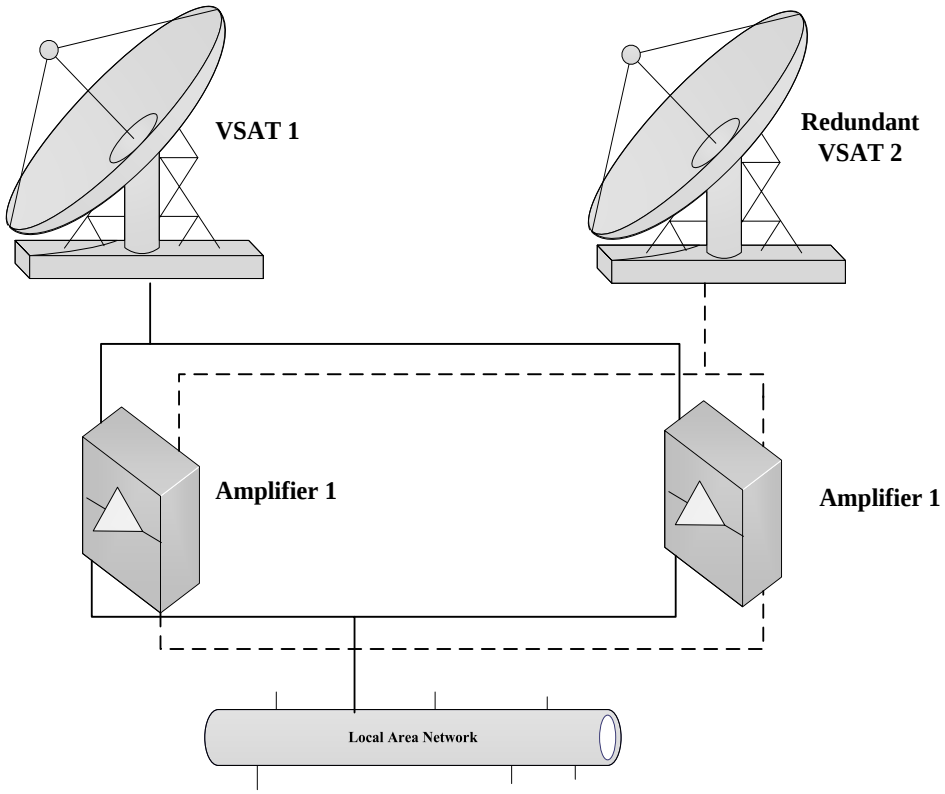

Figure 3. Redundant satellite earth station without backup. Adapted from "Service Availability Analysis in Communication-Based Train Control Systems Using Wireless Local Area Networks," by Z. Li, F.R. Yu, and N. Bin, 2015, *Wireless Communications & Mobile Computing*, *15*, p. 16-29.

Figure 4. Redundant Satellite Earth Station with Backup

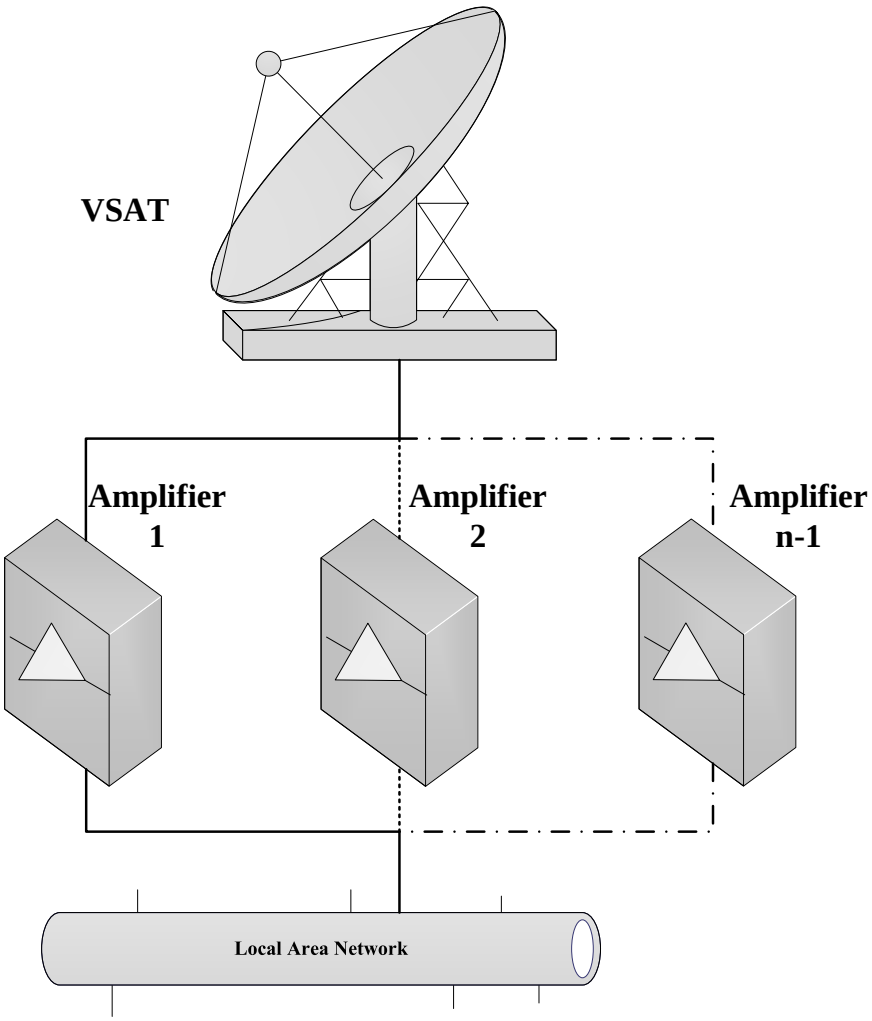

Figure 4. Redundant satellite earth station with backup**.** Adapted from "Service Availability Analysis in Communication-Based Train Control Systems Using Wireless Local Area Networks," by Z. Li, F.R. Yu, and N. Bin, 2015, *Wireless Communications & Mobile Computing*, *15*, p. 16-29.

Given the critical nature of traffic that pass through SATCOM networks (Sakano et al., 2016), and the fact that SATCOM equipment can perform in various

states of degradation (Wilk-Jakubowski, 2018), SPNs are an appropriate model to determine their reliability when state transitions occur. Kleyner and Volovoi's argument is consistent with this in their position that SPNs are more widely used to determine the reliability of critical systems.

The challenge of modeling a dynamic process requires tools that are sufficiently flexible to adapt to transitions. SPNs traditionally model exponentially distributed transitions and can be used to demonstrate the accuracy of a continuous time Markov chain model (Li et al., 2015). The different types of transitions have resulted in several variants of the SPN (Ferreira, Canhoto Neves, Silva, & de Brito, 2018). Using a variant of the SPN, Deterministic Stochastic Petri Net (DSPN), Li et al. compared different data communication systems to determine the most efficient. Even though in-built software applications can achieve similar results, Lei, Wang, Lin, and Zhong (2014) are of the opinion that SPNs provide a viable alternative because they mimic the dynamic behavior of the networks. Another variant of the SPN, Generalized Stochastic Petri Net (GSPN) provides more details on the behavior of the network, but with a compact analysis when used to analyze the performance of Transmission Control Protocol (TCP) (Vinayak, Krishnaswamy, & Dharmaraja, 2013). As a result, Vinayak et al. recommend GSPN for use in analyzing TCP networks. In a similar analysis on packet networks for voice, inferior performance caused by congestion were verified using GSPNs (Gupta, Dharmaraja, & Arunachalam, 2015) which is consistent with the recommendation of Teixeira, Ribeiro, Oliveira, and Massa (2015) to use GSPNs in

models where the resources are shared. However, SPNs are susceptible to state-space explosions which are caused by the exponential increase in tracking discrete changes in dynamic systems (Groote, Kouters, & Osaiweran, 2015). At the core of the GSPN is the ability to analyze performance based on erratic and timed transitions from one state to another, and the type of system being modeled which is used to select the appropriate Petri net.

An effective SPN model can be built if the basic elements and rules are followed. Drawing from the process of building an SPN from multiple authors (Bistouni & Jahanshahi, 2014; Callou, Ferreira, Maciel, Tutsch, & Souza, 2014; Distefano, Longo, & Scarpa, 2017; Li, Zeng, Hong, & Zhou, 2016), the elements are (a) places represented by circles, (b) immediate transitions represented by thin black bars, (c) timed transitions represented by rectangular opaque bars, (d) tokens represented by dots, (e) input/output and inhibitor represented by arcs with arrow heads, (f) markings represented by a vector of tokens and places, and (g) firing rules which are as a result of an activity. Referring to the RBD model in Figure 2, the SPN can be modeled as shown in Figure 5.

Figure 5. SPN Model of a Hybrid Satellite-terrestrial Network

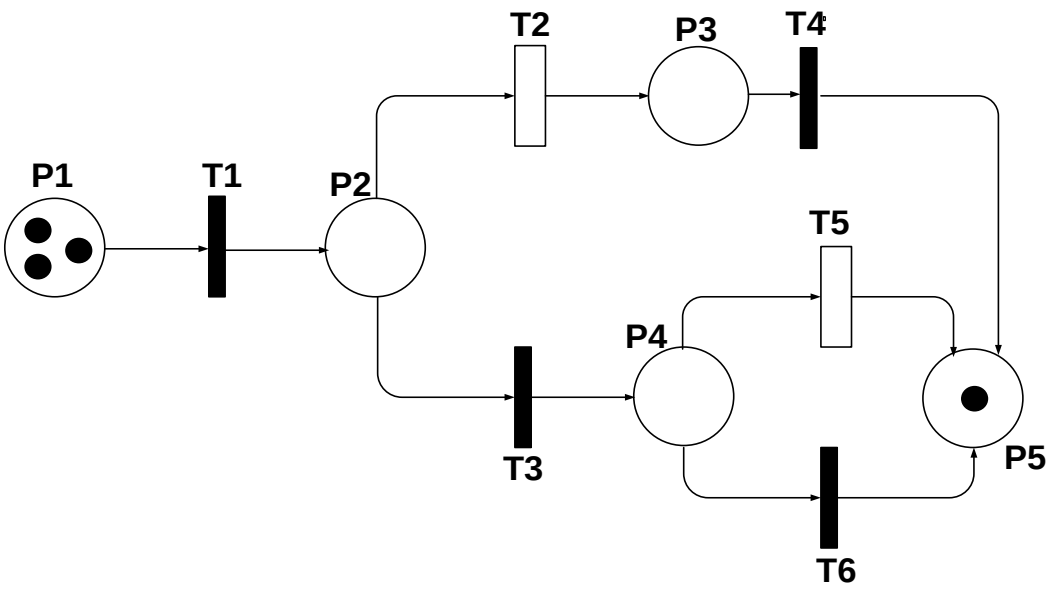

Figure 5. SPN model of a hybrid satellite-terrestrial network. Adapted from "An integrated modeling approach to evaluate and optimize data center sustainability, dependability and cost," by G. Callou, J. Ferreira, P. Maciel, D. Tutsch, and R. Souza, 2014, *Energies, 7, p.* 238–277.

Table 2

SPN Table of Names and Meanings

Name	Meaning
P1	Number of tokens
P2	Waiting to transmit traffic
P3, P4	Waiting to receive traffic

(table continues)

T1, T3, T4, T6	Transferring packets. Immediate transitions
T2, T5	Transferring packets. Timed transitions
P5	Active state

Satellite interference. The management of satellite radio interference is critical to the reliability of a SATCOM network. Broadband applications over satellite links cannot operate well when there is radio interference ("Broadband access by fixed-satellite service systems," 2015). Modern-day Geostationary Earth Orbiting (GEO) satellites support high throughput data which is estimated to exceed 500Gbps by 2020 (Lutz, 2015). With the higher frequency ranges, Lutz further argued that frequency reuse and closely positioned spot beams have made high throughput satellites (HTS) more susceptible to co-channel, and adjacent channel interference. Space usage has expanded to include lesser known entities which has led to this congestion (Harris III, 2014). In spite of this, counter measures by maintaining a cross-over of 3 to 5dB between spot beams still permit high throughputs from small antennas (Montero, Ocampo, & Fonseca, 2015). The use of higher frequencies implies that HTSs are more easily affected by atmospheric conditions especially in the Ka-band of frequencies (Kourogiorgas et al., 2014; Zhou, Jong, & Lo, 2015). Adding to the discourse, the mobility of VSATs for commercial and military purposes has increased the incidence of adjacent satellite interference (ASI) (Li, Zhu, & Luo, 2017; Weerackody, 2016). The demand for larger

bandwidth capacity to support commercial, emergency and military services could be driven by the customers need for access to cloud services in addition to real-time applications like voice, video and online streaming services. While SATCOM operators are making efforts to meet these demands, the laws of physics have required the use of higher frequencies that support larger bandwidths. The use of spot beams has three implications, either that users are concentrated in an area, or there are a few users with high capacity requirements in an area, or in both scenarios. In effect, the use of higher frequencies, demand for large bandwidth, and mobility of the VSATs are three viable perspectives from which to address SATCOM failures due to interference.

The Effective Isotropic Radiated Power (EIRP) is a key element to manage ASI. Even though satellite footprints are designed to avoid intra-system radio interference when frequencies are reused over large areas, radio interference can still occur due to VSAT pointing errors which change the expected EIRP levels ("Methodology to estimate the sensitivity of GSO FSS interference levels," 2015; "Sharing studies between International Mobile Telecommunication," 2015). The effect is pronounced in Multi Frequency-Time Division Multiple Access (MF-TDMA) networks because the victim receivers can experience random hits of radio interference caused by the legitimate transmission of numerous return links (“S.2029: Statistical methodology to assess time-varying interference,” 2012). Interference occurring in MF-TDMA networks can be modeled in three ways (a) statistical modeling of the EIRP levels from each site, (b) interference power

spectral density (PSD) from each location, and (c) quantized mapping of the locations ("Methodology to estimate the sensitivity of GSO FSS interference levels," 2015). Each of these methods requires an intimate knowledge of all the parameters that make up the link budget. However, the probability density function (PDF) from the statistical model of the EIRP, is a relatively simple method to verify the probability of interference occurring in an ASI scenario using the equation:

$$\int_R pr\,(r)\,dr$$

Knowing the PDF places the NA in an advantageous position. They can anticipate ASI occurring, and therefore can plan for strategies to mitigate SATCOM failures. The ITU recommends that the off-axis limits should fall into 3 categories ("S.524: Maximum permissible levels of off-axis e.i.r.p," 2006):

Angle off-axis	Maximum e.i.r.p. per 4 kHz
$2.5° \leq \phi < 48°$	$(35 - 25 \log \phi)$ dB (W/4 kHz)
$48° \leq \phi \leq 180°$	–7 dB (W/4 kHz)

Given that satellites are built with thresholds for withstanding interference (Sharma, Chatzinotas, & Ottersten, 2013), and VSATs in MF-TDMA networks have off-axis emission limits ("Methodology to estimate the sensitivity of GSO FSS interference levels," 2015), it follows that reducing the EIRP levels within these thresholds and within the target region could significantly reduce the impact of the interference. However, for a VSAT working in the Ku-band and Ka-band set

of frequencies, the connection is at a higher risk of failure due to rain fade than ASI (Panagopoulos, Kritikos, Livieratos, & Kanellopoulos, 2014). Nevertheless, Panagopoulos et al. argued that increasing antenna displacement between adjacent spot beams can reduce the risk and impact of ASI, albeit, this would most probably go into the pre-planning phase before a deployment.

The concurrent use of the SATCOM downlink C-band frequencies in terrestrial wireless services has driven multiple schemes to reduce the effect of interference. In line with this, the ITU recommends that separation distances take into consideration the EIRP, path loss, antenna height, and the discrimination angle ("Interference effect of transmissions from earth stations," 2015). Nevertheless, coexistence can be achieved with the interference if the frequencies fall into either a co-channel, a contiguously adjacent channel or an adjacent channel with a guard band in between them (Abdulrazak & Hameed, 2014). In their empirical analysis, Abdulrazak and Hameed observed that the separation distances in dense, urban, suburban, and rural areas could be used to mitigate the effect of interference when the frequency offset is in the 36MHz range. Even though this is not a practical measure when the infrastructure is in a production network, Abdulrazak and Hameed argued that it can be achieved by adjusting antenna heights to reduce clutter noise which is a function of the separation distance. In fact, Hamid, Tariq, Majed, and Rahm (2015) showed consistency using similar arguments that the losses due to clutter and the terrain could be advantageous in limiting the exposure

of a fixed-satellite service (FSS) earth station (ES) to interference. The propagation model used by Hamid et al. is reproduced in table 3.

Table 3

FSS ES System Parameters

Parameter	Value
Center frequency of operation	3500 MHz
Channel Bandwidth	72 MHz
Receiver Noise Temperature	60 K
Antenna Diameter/Type	2.4m (ITU RR AP7)/Parabolic
Maximum Antenna Gain	41 dBi
Antenna Radiation Pattern	Rec. ITU-R SM.1541
Antenna Height Above Ground	5 m
Elevation Angle	5 ~ 80 deg
Coexistence Criteria (I/N)	-10 dB
Receiver Thermal Noise, N = KTB	-140.03 dBW

Note. From Hamid, Z. A., Tariq, K. R., Majed, M. B., & Rahm, T. D. (2015). Spectrum Investigation for Sharing Analysis Between Broadband Wireless access (BWA) System and FSS Receiver. *Journal of Theoretical and Applied Information Technology, 81*(2), 166. Reprinted with Permission Under the Creative Commons License (see Appendix E).

Table 4

BWA Station Parameters

Parameter	Value
Center frequency of operation	3500 MHz
Multiple Access	OFDM
Subcarrier Freq. Spacing	12.2 kHz
Total Number of subcarriers	4096
Bandwidth	4 MHz per sector
Output Power	27 dBm/4MHz
Maximum Antenna Gain	14.5 dBi
Antenna Height	10m
Antenna Pattern	Omni

Note. From Hamid, Z. A., Tariq, K. R., Majed, M. B., & Rahm, T. D. (2015). Spectrum Investigation for Sharing Analysis Between BWA System and FSS

Receiver. *Journal of Theoretical and Applied Information Technology*. *81*(2), 166. Reprinted with Permission Under Creative Commons License (see Appendix E). Hamid et al. (2015) calculated the protection distance and the minimum loss, the aim being to verify that the EIRP of the FSS connection exceeds that of the interfering source to avoid disruption of service to the FSS ES.

Protection distance is given by the formula:

$$20\text{Log}(d) = -I + EIRP_{FWA} + Gr + Lr - 32.5 - 20\text{Log}(F) - A_h - R$$

The minimum loss is given by the formula:

$$L_{min} = Pt + Gt + Lr - I_{max}$$

Simulations of BWA and FSS ES networks operating in adjacent extended C-band frequencies showed that there was still a high possibility of interference to the ES even with a clutter loss of 10dB and site shielding of 40dB (Sari & Mahyastuty, 2013). In these scenarios, it would be advantageous to ensure the Bit Error Probability (BEP) recommended by the ITU are not exceeded for the bit rate utilized in the analysis ("S.1521: Allowable error performance," 2001). Given that a BEP value of 1×10^{-8} is an unavailability threshold, any values less than this would indicate an error-free link based on the bit rate selected if the availability is captured over a long period ("S.1521: Allowable error performance," 2001). The net implication is that, if available, a baseline BEP value of 1×10^{-8} can be used to determine whether a separation is needed to identify interference. Afterwards, countermeasures of adjusting the separation distances, EIRP levels and coding can

be enforced with the aim of achieving EIRP and bandwidth levels higher than the interfering source

Transition and Summary

In Section 1, I provided a background to the problem, the problem and purpose statements, nature of the study, research question and the interview questions. I also introduced the conceptual framework and provided a literature review. SATCOM is a technology that has gained roots in disaster-relief and humanitarian operations because of the non-reliance on distance, the multiple uses for global positioning systems, voice, data, Internet as well as the integration with terrestrial networks. As a result, a failure in a SATCOM link can have a ripple effect on multiple facets of a disaster-relief effort. The conceptual framework introduces a concept where the organizations involved may have the internal expertise to resolve a SATCOM failure without recourse to external expertise. The benefits of a quick resolution can have a profound impact on social change since it frees essential resources to concentrate on the core function of the mission. These could be services in health, evacuation, sanitation, water, and shelter. Also, the literature review considered the causes of these SATCOM failures, predominantly being radio frequency interference, and the most favorable alternative recovery method being the activation of secondary connection.

In Section 2, I will restate the problem statement and identify the role of the researcher with respect to this qualitative case study. Also, I will discuss the research methods and design into greater depth to justify my selection. My strategy

for the data collection and analysis will be discussed, and how I will ensure reliability and validity in this study.

In Section 3, I will perform the functions outlined in section two, namely conducting semi structured interviews and transcribing the data for analysis. At the same time, I will take into consideration the protocol to ensure validity and reliability are at acceptable levels and bias is reduced to the minimum. I will also provide an analysis of the data collected with applications to professional practice.

Section 2: The Project

In Section2, I will restate the purpose statement and discuss the role of the researcher, research method and design, population, and sample sizes. I will also discuss the protocol interview to be used and describe how I will collect and analyze the data for analysis. I will also discuss the reliability and validity of the study.

Purpose Statement

The purpose of this qualitative single case study was to explore strategies used by NAs deployed for disaster relief operations to recover from SATCOM failures. The participants were NAs working in a large government institution who had been deployed for disaster relief operations in Asia, the Middle East, Central Africa, East Africa, and West Africa; and who also had strategies to recover from SATCOM failures. Implications for positive social change are the opportunities gained by humanitarian workers to (a) potentially to save lives when SATCOM is used in early warning systems and emergency response, where the aim is to communicate imminent dangers to the largest audience in a short timeframe, (b) the need of humanitarian workers to communicate to the donor community, the nutritional, clothing, shelter, educational and medical needs of the affected population during a disaster, (c) utilize satellite news gathering which enables news broadcasts to draw global attention to the need for material and financial assistance, and (d) the use of telemedicine to help physicians located remotely from

the disaster, to diagnose ailments or recommend treatments of the victims in real time.

Role of the Researcher

In this study, I was the researcher who replicated the subject matter and explained the differences that occurred. In qualitative research, the researcher collects data and identifies causes and effects that can be used for casual inferences (Bennett & McWhorter, 2016). From the year 1999 to 2019, I was involved in the deployment of SATCOM networks for private, commercial, and corporate entities. Between the years 2008 and 2017, I was focused on managing the SATCOM network of a large government organization spanning multiple locations across the globe. During that period, I had to contend with SATCOM interference in various environments and sought solutions, some of which were successful, and others that were not successful. My support for these SATCOM networks can be viewed as a source of bias because I was known to the participants of this study, and I could have swayed the interviews to reflect my personal views and experience regarding this phenomenon. However, bias and perceptions of bias can be mitigated through the transparent disclosure and deliberate interrogation of interaction of sources used in a study (Roulston & Shelton, 2015; Sanders, 2015).

I completed the National Institutes of Health (NIH) web-based training course on protecting human research participants. The NIH course was based on the Belmont Report, which was promulgated to protect human subjects used in research, namely (a) respect for persons, (b) beneficence, and (c) justice (Office for

Human Research Protections, 1979). To adhere to respect for persons, the participants in a study must be autonomous, informed of any risks involved in taking part in the study, and be aware of any misconceptions so that they can make informed decisions (Koonrungsesomboon & Karbwang, 2016). In line with this, my participants were autonomous persons running operational networks. Furthermore, they were made aware of any risks with clear expectations of the study to nullify any ambiguity. Beneficence also includes adhering the wishes of the participants regarding which third parties can access their data (White, 2017). I recorded the wishes of these participants before proceeding with the interviews to reduce the possibility of harm. In the Belmont Report, justice requires that all participants are treated equally, especially if there is any compensation. I followed this guideline and also did not select participants that were vulnerable to exploitation. These included, but were not limited to the elderly, children, pregnant women, and persons who were ill or in dire conditions. Depending on the purpose of the study, the selection of subjects in social research requires detailed evaluation to ensure the participants are not susceptible to exploitation or placed at risk (Wessels & Visagie, 2017).

Reducing the impact of one type of bias can increase the effect of another type of bias, and furthermore, the tools selected by a researcher in a study can lead to bias (Evers, Hiligsmann, & Adarkwah, 2015). However, the researcher can mitigate this semblance of bias by being transparent about his or her background

(Robinson, 2014). Aside from being open about my background in relation to this study, I applied the conceptual framework against my study to reduce bias.

Before commencing a study, it is recommended to compile a protocol which would facilitate the extraction of valuable data and reduce the appearance of bias (Drabble, Trocki, Salcedo, Walker, & Korcha, 2015; McKim, 2016). Castillo-Montoya (2016) suggested four steps to ensure a good protocol is compiled: (a) ensuring alignment with the research question, (b) inquiry-based conversation, (c) peer feedback on the protocol, and (d) piloting the protocol. Since I was playing the role of the researcher, I followed these protocols and requested the support of my peers and committee in piloting the protocol before use.

Participants

The selection of participants was based on the underlying research question. According to Cleary, Horsfall, and Hayter (2014), the research question should be the basis for selecting participants in a qualitative study. The participants in this study were NAs working in a large government organization providing humanitarian assistance in the Middle East and Africa. The participants selected had certification in satellite communication issued by the Global VSAT Forum (GVF). These certifications were any of the following:

GVF-CERT-SPB: Basic Satcom Professional Certification

GVF-CERT-SPID: Satcom Professional iDirect Specialist Certification

GVF-CERT-SPA: Advanced Satcom Professional Certification

GVF510: Core Skills for VSAT Professionals

GVF503i: iDirect Installation and Maintenance

Another criterion was that the participants had experienced some form of interference or outage in their SATCOM infrastructure from September 2017 to September 2018. Those experiences ensured that the data reflected current strategies they used to address the research question. In research, experiencing a phenomenon enables participants to provide rich details on the actions and the reasons behind any solutions (Perridge, Hefferon, Lomas, & Ivtzan, 2017).

Since I was in charge of technical support for satellite services in a government organization, I had already established professional relationships with the potential participants. According to Webster (2016), professional relationships are important in obtaining access to participants during an interview. The interviews were conducted using Skype. Valuable information can be acquired from participants if a good relationship is established and the location is convenient for them (Mason & Ide, 2014). In my current capacity as the Information and Communication Technology Specialist heading the IT unit in a country office, I was providing supporting roles in SATCOM and other technology areas when needed. Such supporting roles built rapport with the participants that ultimately improved collaboration during the interviews. According to Bettez (2014), the establishment of rapport in research can result in the free flow of information between the researcher and the participant.

Research Method and Design

The objective of this study was to identify the strategies used by NAs to recover from SATCOM failures. Since I did not have a large number of organizations to choose from, and I wanted to understand the depth of the strategies, a qualitative approach was appropriate for this study. Qualitative research is used in situations where a depth of understanding is needed, and the participants are active participants in the phenomenon under study (Boddy, 2016). I wanted data from a unique environment, that is, NAs working in disaster-relief or humanitarian settings, therefore I used a single case study. Single case studies are appropriate for situations where the researcher needs unusual research access and unique examples (De Massis & Kotlar, 2014)

Method

Quantitative, qualitative, and mixed methods study designs were considered for use in my study. The questions posed by a researcher in both quantitative and qualitative methods are influenced by the researcher's beliefs (Leppink, 2017). Quantitative research is used to generalize a sample across a wider population where an attempt is made to equate a sample to a worldly counterpart (Zyphur & Pierides, 2017). Even though this introduces a dilemma of validity, the measurement tools used in quantitative research can still improve the validity and reliability of the study (Tavakol & Sandars, 2014a). Nevertheless, some researchers reject the use of these type of results as a best practice to apply across the board since the context is not taken into consideration (Buckley, Brown, Thomson,

Olsen, & Carter, 2015). According to Nordsteien, Horntvedt, and Syse (2017), the context should drive the decision to use qualitative and quantitative data. The context of this study was in disaster-relief operations, without the intention of generalizing the data across other SATCOM areas. I, therefore, rejected the use of a quantitative method.

Mixed methods research is a combination of the elements of qualitative and quantitative methods to provide a unique perspective to a study (Plano Clark, 2016). Whereas different methodologies can produce different answers to a research question (Turner, Cardinal, & Burton, 2016), the decision to use a mixed method must have an added value given the constraints of time, resources, and expertise (McKim, 2016). Embarking on a mixed methods study requires that the quantitative and qualitative sources are integrated, and have a philosophical foundation (Mabila, 2017). Even though quantitative research can be used to answer qualitative research questions using some regressive analysis methods like regression and path analysis (Leppink, 2017), there are still some questions that need a qualitative method to answer the “how” and “why” (McKim, 2016). Coupled with the fact that the quantitative component could rely on probabilities to generalize an outcome of a study (Zyphur & Pierides, 2017), which was not my intention, I did not use a mixed method.

NAs are tasked with maintaining increasingly complex networks using all ethical means within their professional capacity (Forsgren, Durcikova, & Mills, 2016). Such details require inductive reasoning which can be explained through a

qualitative study (Tavakol & Sandars, 2014a). Qualitative research is used to draw out the actions taken for a given phenomenon by asking the "how" and "why" as opposed to numerical data in quantitative research (McCusker & Gunaydin, 2015). Unlike a quantitative method where the researcher is isolated from the phenomenon, a researcher uses a qualitative method to collaborate with the participants to extract objective information which addresses the research question (Florczak, 2017). Such an approach does not necessarily imply that a quantitative method cannot address the research question. Since qualitative methods do not depend on probability and random samples (Windsong, 2016), the researcher can check the reasoning behind any action of a participant (Sayago, 2014). Therefore, I used a qualitative method for this study.

Research Design

In phenomenological research, Adams and van Manen (2017) argued that the same research question lends itself to different interpretations when using other methods of research. These could be to tell a story, ethnicity or even attempt to understand the theory behind an experience. A phenomenological method would seek an experiential understanding of the subject matter, in other words, the lived experiences of the target population that have experienced a phenomenon (Paul, 2017; Petty, Thomson, & Stew, 2012). With this study, I did not seek to understand the lived experiences of the participants, but rather understand what actions the participants took when the phenomenon was experienced. Therefore, a phenomenological method was not used for this study.

I did not use a narrative design for this study. Narratives require that the phenomenon under study is documented over a period by different non-partial parties (Miller, 2017). Even though I could have benefited from a documented narrative of SATCOM failures, narratives suffer from a lack of information and are dependent on the subjective opinions of the participants of the study (Adler et al., 2017). Similarly, Moezzi, Janda, and Rotmann (2017) argued that life-based experiences of an interviewee can be a mixture of facts and fiction which challenges the extraction of true events. These were consistent with another argument that narratives tend to produce information that is relevant to the interviewee (Goldstein, 2017; Haydon, Browne, & van der Riet, 2018; McAloon et al., 2017). However, I sought information based on actual events that were not from the perspective of the participants. Therefore, a narrative was not suitable for this study.

I did not use an ethnographic design for this study. Ethnographic research intertwines the identity of the researcher with the identity of individuals, gender, age and race (Alcadipani, Westwood, & Rosa, 2014). Such a process would have been a distraction to following the core requirements of answering the underlying research question. A characteristic of ethnographic research is the use of informal interviews and observation involving the researcher and the participants (Elmusharaf, Byrne, Manandhar, Hemmings, & O'Donovan, 2016; Hallett & Barber, 2013; Liabo, 2016). I rather used semi-structured interviews without the need to observe participants who have experienced the phenomenon in the past.

Ethnographic research characteristically takes a considerable length of time and contributes to modifying or developing a new theory (Morse, 2016). It was not my intention to modify or develop a new theory. Therefore, an ethnographic design was deemed unsuitable.

I used a single case study for this research. The advantage of a case study method is that a phenomenon can be studied into depth which is common with empirical studies (Dresch, Pacheco Lacerda, & Cauchick Miguel, 2015). Furthermore, single case studies have strong internal validity because they directly address the phenomenon (Ennis, Jolivette, & Losinski, 2017). The quality of a case study depends on the early decisions whether the study is a representative or non-representative sample of the case (Herron & Quinn, 2014). Goodyear (2016) used this case study principle to understand the relationship between continuing professional development, and the effect on student learning. Similarly, early in their study, Whalon, Conroy, Martinez, and Werch (2015) used the same principle to decide on the type of case study to perform social skills interventions. In effect, a case study is used to study a phenomenon within environmental contexts which are integral to the study (Morgan, Pullon, Macdonald, McKinlay, & Gray, 2016; Ridder, 2017), which aligned with the research question and therefore made a case study design the most suitable choice for this study.

I used multiple sources of information for triangulation to ensure that saturation was achieved. Patton (1999) describes triangulation as comparing the data acquired using different data sources since the reliance on a single source can

lead to errors and bias. Although the interpretation of the triangulated results is dependent on the perspectives of the researchers (Varpio, Ajjawi, Monrouxe, O'Brien, & Rees, 2016) seminal authors agree that a case study requires the use of multiple sources of data which facilitates triangulation, and therefore increases the chances of saturation (Carolan, Forbat, & Smith, 2015; Fusch & Ness, 2015; Patton, 1999). However, it is worth noting that saturation cannot be reached, and the methodology may not be consistent if all the participants are not asked the same questions (Barrett, Mazerolle, & Eason, 2016; Fusch & Ness, 2015; Guest, Bunce, & Johnson, 2006; Hennink, Kaiser, & Marconi, 2016).

Population and Sampling

This study was targeted at NAs working for a large government organization providing disaster relief activities. The participants had experienced some form of SATCOM failure which necessitated resolution or alternative means of communication. Additionally, the participants had SATCOM training which was a basis for the effective management of the VSAT. To obtain rich information and innovative ideas in the face of adversity, nine countries in six geographic areas with heightened levels of disaster-relief activities were targeted; Asia, the Middle East, Central Africa, East Africa, and West Africa. The available and eligible participants in these countries were interviewed until thematic saturation was achieved. Thematic saturation occurs when no new themes emerge out of interviewing the participants in a study (Humphries, Radice, & Lauzier, 2017; Gagliardi et al., 2017; Namey, Guest, McKenna, & Chen, 2016).

For a qualitative case study, a sample size of twelve is a good starting point but should also take into cognizance the research question and the quality of the samples used (Boddy, 2016; Guest et al., 2006; Hennink et al., 2016). Also, it is worth noting that excessively large sample sizes waste resources and introduce ethical issues (Cesana & Antonelli, 2016; Chen, Li, & Lan, 2015; Koran, 2016). However, all the authors agreed that researchers must budget for more than this number and that homogeneity, interview structure and content influence the saturation point. Fusch and Ness (2015) argued that it is not the absence of new information that indicates saturation, but rather the quality of the samples used, where a sample size as small as six can be used to reach saturation if the information is rich. Furthermore, the precision of the questions can enable saturation quickly, where the purpose of the study, the logic of the sampling, and constraints can be used to determine the discontinuation of sampling (Suri, 2011). I had anticipated a minimum number of twelve participants and a maximum number of 24 participants. Nine participants responded and all of them were eligible. Since there were no responses from eligible participants in some locations, I was unable to reach thematic saturation in some geographical areas. However, the study was a single case study and not a multiple case study, therefore, I was able to reach saturation across the entire case.

A purposeful sampling method was used for this study. Together with a qualitative method, purposeful sampling is often used in case study research to gather rich details about a phenomenon (Benoot, Hannes, & Bilsen, 2016; Gentles

et al., 2015; Palinkas et al., 2013). I selected participants based on their expertise in the SATCOM domain and the experience of the phenomenon. While purposeful sampling is useful in unique environments where the outcome can potentially be applied across similar cases, the researcher must recruit participants based on a clear criterion of the value they will add to the study (Ko, 2016; Palinkas et al., 2013; Ridder, 2017).

I asked the participants the same questions in semi-structured interviews and triangulated three data sources by (a) comparing the descriptions the participants provided of the phenomenon, (b) reviewing the network monitoring statistics, and (c) performing member checks. Member checks are a process where the feedback of participants is sought on the study for accuracy (Neuman, 2014; Thomas, 2016; Varpio et al., 2016).

I conducted semi-structured interviews using Skype, which was convenient to the participants. Semi-structured interviews are based on key questions that open discussions around themes (Fisher, Boland, & Lyytinen, 2016; Galvin, 2015; Mak & Singleton, 2017). Semi-structured interviews have common features where they must be based on the research question, on previous knowledge of the phenomenon and must be piloted at a point before usage (Castillo-Montoya, 2016; Ilyushin & Azbel, 2017; Kallio, Pietilä, Johnson, & Kangasniemi, 2016). Semi-

structured interviews can be used to determine participant's viewpoints and introduce new themes on practices using open-ended questions (Feiring & Walter, 2017; Kahraman & Kuzu, 2016; Teixeira Vinci, Lopes Rijo, de Azevedo Marques,

& Alves, 2017). In addition to taking notes, audio recordings were taken of the interviews for transcription. Recording interviews help the researcher to categorize items to identify themes relevant to the study (Afseth & Paterson, 2017; Barrett et al., 2016; Pawluk & Zolezzi, 2017).

Ethical Research

There are three primary areas for ethical consideration in the Belmont Report which are, (a) the respect for persons, (b) beneficence, and (c) justice (Office for human research protections, 1979). Respect for persons requires that the researcher protects all participants, be they autonomous or non-autonomous. Beneficence requires that the researcher treats all participants with respect and their well-being is sought at all stages of participation. Justice is a requirement that all participants are treated equally and rewarded appropriately irrespective of their background. Further to the completion of the National Institutes of Health (NIH) web-based training course on Protecting Human Research Participants, I followed these principles throughout the study. According to Friesen, Kearns, Redman, and Caplan (2017), the Belmont report has two clear objectives; to contribute to general knowledge and improve the well-being of participants.

While the boundary between these objectives of the Belmont Report has become clouded over the years (Friesen et al., 2017), I ensured that I adhered to the principles of the report. Prior to review by the Institutional Review Board (IRB), I assessed the risks associated and mitigation methods for participating in this study. The risks to the participants were not beyond any risks in their operational

functions which covered the Respect for Persons requirements of the Belmont Report. Beneficence was considered since the results from this study helped the participants to improve the resilience of their SATCOM networks in disaster-relief environments.

Participants were at liberty to withdraw from the study at any time by sending me an email indicating their intentions. Also, during the interview, I informed the participants that they could withdraw from the study at any time, further to which I would have terminated the interview and deleted any recordings or notes taken during that period. The decision to take part in a study can be enhanced if the participants are informed of the risks and reasons some other participants refused to participate (Kraft, Porter, Shah, & Wilfond, 2017; Lantos, 2017; Sade, 2017). Participation in a study must be optional, and the participants should be preferably autonomous (Johansson, Soekadar, & Clausen, 2017; Rhodes, 2017; Spencer, 2017). I did not provide compensation for participating in this study as no additional expenses were incurred for this study. Ethics committees do not encourage remuneration and prefer reimbursement of expenses (Collins et al., 2017; Polacsek, Boardman, & McCann, 2016; Porteri, Togni, & Pasqualetti, 2013). In alignment with beneficence in the Belmont Report, I will ensure that all the participants are provided with the results of the study for possible inclusion in their disaster recovery plans or plans to expand their SATCOM networks. In consideration of the respect for persons, I provided each participant with a consent form delineating the purpose of the study, the risks, assurance of anonymity, and

the benefits. All the data collected will be encrypted and password protected for five years, as per the policy of Walden University.

Data Collection

Instruments

The data collection process poses challenges to both the researcher and the interviewee. Some of these are establishing rapport, hesitation to participate and inexperience of the researcher in conducting interviews (Agula, Barrett, & Tobi, 2015; Lijadi & van Schalkwyk, 2015; Rimando et al., 2015). In case studies, the researcher can be the primary data collection instrument who establishes relationships with the participants, conducts interviews and analyzes the data (Aulgur, 2016; De Massis, & Kotlar, 2014; McCormick, Lee, Cesare, Shojaie, & Spiro, 2015). A consistent application of the instrument across all participants in the same context contributes the validity of the study (Emmanuel & Clow, 2017; Teixeira Vinci et al., 2017; Toye, Sheppard, & Chen, 2016).

The use of semi-structured interviews for all the participants allowed me to table open-ended questions that encouraged the participants to provide detailed explanations of the phenomenon. Semi-structured interviews can be used by researchers to obtain an understanding of phenomenon from the point of view of the participant (Magudu & Gumbo, 2017; Mason & Ide, 2014; Webster, 2016). In fact, Kennedy and Miceli (2016) observed that the use of a semi-structured interview resulted in additional unexpected information which reinforced their argument that semi-structured interviews can produce objective information.

Additionally, open-ended questions can extract the thoughts of the participant, with follow up questions being used to seek clarifications and guide the conversation towards answering the research question (Bartlett, M., & Bartlett, J., 2016; Castillo-Montoya, 2016; Webster, 2016). The interview protocol that is outlined in Appendix B was followed. However, before then, I piloted the interview protocol with classmates and my Chair to ensure clarity and conciseness. Piloting a protocol before use can improve the quality of information obtained (Castillo-Montoya, 2016; Ilyushin & Azbel, 2017; Pelletier et al., 2016). After transcription, I performed member checking to validate the information captured and to allow the interviewees to make amendments they saw as appropriate. Member checking is a way of validating and enhancing the quality of the data (Hallett & Barber, 2013; De Massis & Kotlar, 2014; Thomas, 2016).

Data Collection Technique

Data was extracted through semi-structured interviews after approval had been obtained from the Institutional Review Board (IRB). The interviews were conducted via Skype which was convenient to the participants. The primary reason was that telephone interviews reduce logistical overheads and are convenient when the participants are widely dispersed (Drabble et al., 2015; Hennink et al., 2016; Solmaz et al., 2015). The downside is that the lack of a face-to-face interview can reduce rapport between the researcher and the interviewee, and the researcher could also miss the bodily queues that reflect the discomfort of the participant's train of thought (Coates, Phelan, Heap, & Howe, 2017; Hallett & Barber, 2013;

O'Cathain et al., 2014a;). However, the use of telephone communication is common for qualitative research by ensuring inclusivity (Nandi & Platt, 2016; Ward, Gott, & Hoare, 2015), and is still a more comfortable choice for the participants due its convenience and prevalence in society (Allen-Walker et al., 2017; Jago, & Radford, 2016; O'Cathain et al., 2014b).

The interview protocol was followed with each interviewee which ensured that all relevant areas were adequately covered. Interview protocols are used to ensure that each session is conducted within a timeframe, the research question is properly addressed, bias is reduced, and validity is enhanced (Castillo-Montoya, 2016; Drabble et al., 2015; McKim, 2016). After interviews and transcriptions were completed, I conducted member checking to validate my findings. Member checking allows research participants to clarify details of their contributions which increase the validity of the findings (De Massis & Kotlar, 2014; Hall, Chai, & Albrecht, 2016; Hallett & Barber, 2013).

Data Organization Techniques

When the data collected in research are well organized, it facilitates retrieval, reuse, and reproduction of the study (Clark, Birkhead, Fernandez, & Egger, 2017; Munafò et al., 2017; Toye, Sheppard, & Chen, 2016). I used Microsoft Excel to record emerging themes. Microsoft Excel is a software application that can be used to identify, filter and interpret relationships between figures (Ţarcă, 2015). Each participant was provided with a number which was neither associated with their locations nor their names to ensure anonymity. The

data captured for each participant was assigned to each participant's number which helped to catalog emerging trends out of the interviews. In research processes, the raw data must be cataloged in a manner that it can be filtered to select the data that answers the research question (Boddy, Cowan, Gibson, & Britten, 2017; Hoeber, Snelgrove, Hoeber, & Wood, 2017; Maher, 2014). Using the filtering function in Microsoft Excel, I was able to sort the data into categories. I did not write down any notes. I rather used Microsoft Word to take notes of comments made by the participant on the fly that proved useful in the data analysis. Each note was dated and had a narrative showing what prompted that thought and how it had affected the study. Journals can help to understand themes, prompt the researcher of potential bias and confidentiality breaches, and can be in a variety of formats (Berman, 2017; Kemp et al., 2016; Ummel & Achille, 2016). All the raw data will be encrypted, and password protected on three external flash drives (a primary and two backup copies). The external flash drives will be placed in a safe for five years, and after that, the data will be permanently erased.

Data Analysis Technique

There are five general steps that can be identified in data analysis; (a) content analysis, (b) open coding, (c) forming categories, (d) developing themes, and (e) developing a model (Hoeber et al., 2017; Ramani & Mann, 2015; Ummel & Achille, 2016). Out of these, two approaches can be used in qualitative research, deductive and inductive analysis. Deductive analysis is driven by a theoretical framework and an inductive analysis is driven by the data collected, all within the

framework of the research question (Baxter & Jack, 2008; Feiring & Walter, 2017; Hennink et al., 2016; Voyer et al., 2016).

The inaccurate transcription of an interview can invalidate a study (Afseth & Paterson, 2017; Clark et al., 2017; Toye et al., 2016). I had the interviews transcribed by Rev.com which enabled me to collate the data into an Excel spreadsheet. The use of a transcription service in research can facilitate the processing of the data, but there should be due cognizance of the confidentiality and accuracy (Azzam & Harman, 2016; Clark et al., 2017; McCormick et al., 2015).

I used an inductive approach in this study. In this approach, I read through the transcribed interviews and identified different viewpoints that pointed to different themes. Each theme was assigned a code that I filtered to identify information that answered the research question. Qualitative research is aligned with inductive approaches and can be used to identify themes and sub-themes (Middleton et al., 2016; Smith, Bethune, & Hurley, 2017; Tavakol & Sandars, 2014b).

I used triangulation to analyze the data. I was provided with the performance statistics of the network which included the availability, packet losses, bandwidth utilization, and latency. These details were used for triangulation where the statistics indicated the efficacy of any strategies used for recovery. Triangulation in research is a process of comparing different sources of data for

validity (Kemp et al., 2016; Ummel & Achille, 2016; Williams & McCarthy, 2014).

A triangulation process requires either people, time or space which results in four approaches; an investigation using multiple researchers, the application of multiple theories, a methodology or data comparison (Carter, Bryant-Lukosius, DiCenso, Blythe, & Neville, 2014; Fusch & Ness, 2015; Toye, Sheppard, & Chen, 2016). Since I was the sole investigator in this study, and it was not my intention to apply multiple theories, neither the investigator nor the theory approach was used; but rather the data comparison approach was used. Using different sources of data for triangulation can increase the credibility of a study (Carter et al., 2014; Fusch & Ness, 2015; Johnson et al., 2017).

Figure 6. Data Analysis Scheme

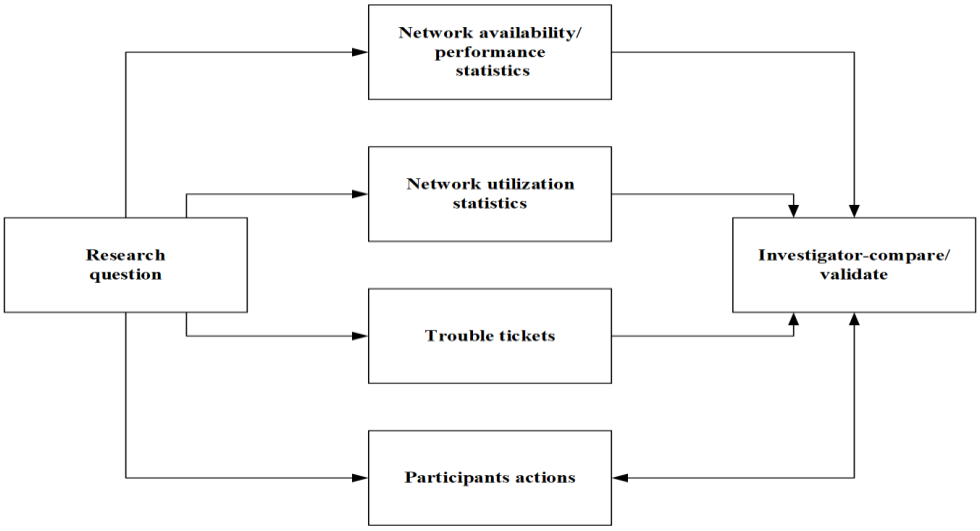

Figure 6. Data Analysis Scheme.

Reliability and Validity

Reliability in qualitative research leads to the predictability and consistency of the results (da Costa et al., 2016; Leung, 2015; Mabila, 2017). Consistency can be achieved when the same instrument, applied to the same participants in different setting produces the same results, while identifying elements that can cause variations (Dikko, 2016; Toye, Sheppard, & Chen, 2016; Vierhout et al., 2017). As an instrument in a study, a researcher must ensure that their results are dependable, transferable, and credible (Arriaza, Nedjat-Haiem, Lee, & Martin, 2015; Leung, 2015; Munafò et al., 2017). Scholarly research must follow a rigorous process to achieve validity. The validity still depends on the purpose of the study which may be to establish truth, generalizability, or discoverability (Dennis, 2017; Green, 2014; Kozleski, 2017). In fact, the rigor in a qualitative study must be enforced from the start of the study using verification techniques because qualitative research is more susceptible to subjectivity (Tuval-Mashiach, 2017; Kemp et al., 2016; Kim et al., 2013; Leung, 2015). Furthermore, the validity is dependent on the constructs used, which can be achieved with semi-structured interviews (Auld, Baker, McGirr, Osborn, & Skaff, 2017; McCarrier et al., 2016; Pandey & Chawla, 2016).

Dependability

Dependability requires the methodical application of various techniques; triangulation, reflexivity, member checking, audit trails, peer debriefing, and prolonged engagement (Hadi & José Closs, 2015; Munn, Porritt, Lockwood,

Aromataris, & Pearson, 2014; Shaw, 2016). According to Korstjens and Moser (2017), the details in the audit trail showing the factors that influence decisions can reflect dependability in the research. However, the use of any of these techniques depends on what the researcher wants to achieve, be it establishing truth, generalizability, or discoverability (Le Roux, 2016; Green, 2014; Kozleski, 2017). I focused my techniques on (a) reflexivity by ensuring I was aware of my biases and unintended influences at every stage of the study, (b) triangulation by using different sources of data to cross-check facts and figures, (c) member checking to ensure that, the information captured was correct, (d) audit trails which took the form of rich descriptions documenting each step of the process, and (e) prolonged engagement with the participants which I conducted in the framework of building rapport.

Creditability

Creditability is demonstrated in a study when there is close collaboration between the researcher and participants using a variety of strategies (Barker & Mamiseishvili, 2014; Carter et al., 2014; Connelly, 2016; Cope, 2014). However, creditability goes beyond collaboration. According to Le Roux (2016), honesty and ethical integrity must permeate throughout the study. I achieved creditability by member checking which involved having the participants cross-check the transcripts of their interviews for accuracy. Additionally, I ensured that the participants had the requisite training in SATCOM and had a working background in disaster-relief to enhance the credibility of the study.

Transferability

Transferability is analogous to generalizability and enables other people to transfer the research to other studies (Cook, Kuper, Hatala, & Ginsburg, 2016; Hadi & José Closs, 2015). Even though there are limitations to the transferability of findings in qualitative research because of the size and context of the reader (Behrens, McCormick, Orero, & Ommeh, 2017; Bickerstaff, Devine-Wright, & Butler, 2015; Gebauer, Haldimann, & Jennings Saul, 2017; Vafeas, 2015), the use of an audit trail with thick descriptions enables others form opinions on how the research can be transferred and applied in other settings (Cope, 2014; Tuval-Mashiach, 2017; Moon, Brewer, Januchowski-Hartley, Adams, & Blackman, 2016). To achieve transferability, I used thick descriptions of the steps and processes to ensure an audit trail can be followed by any researcher to form their conclusions, and if required, transfer to other studies.

Confirmability

Confirmability is the ability to logically link a research process to the conclusion through the quality of the audit trail (Chan, 2017; Heydari, Rahnavard, & Ghaffari, 2017; Moon, Brewer, Januchowski-Hartley, Adams, & Blackman, 2016; Pompeii, 2015). The main requirement for confirmability is to be neutral and transparent on the audit trail throughout the study (Korstjens & Moser, 2017; Van Wijk, Traut, & Julie, 2014). To ensure confirmability and trustworthiness, I provided a clear and impartial audit trail. Confirmability can be achieved by recording the interviews, using external transcribers, member checking and

producing a rich report detailing a thorough chain of evidence (Muthathi, Thurling, & Armstrong, 2017; Steyn, Poggenpoel, & Myburgh, 2017; Zamanzadeh, Ahmadi, Foolady, Behshid, & Irajpoor, 2017). I used an external party to transcribe the interviews which removed elements of bias in the transcription process. I also conducted the interviews with self-awareness to follow the feedback as they unfolded without influencing the discussion. Furthermore, member checking was performed to ensure that my personal views were not imported into the study. Dependability, creditability, transferability, and confirmability are elements that are combined to make a study trustworthy (Rasool & Ross, 2016; Van Wijk et al., 2014; Vuso & James, 2017).

Saturation is important in qualitative studies. Multiple methods of data analysis facilitate saturation which improves the trustworthiness of the study (Hancock, Amankwaa, Revell, & Mueller, 2016; Hennink et al., 2016; Nelson, 2016). Saturation is achieved when there is no additional new information collected from the participants in a study (Boddy, 2016; Robinson, 2014; Van Rijnsoever, 2017). Within the constraints of my sample size, I performed semi-structured interviews with member checking until no new information was provided, which indicated that saturation had been reached.

Transition and Summary

Section two of this proposal revisited the purpose statement and delved into the role of the researcher. Also discussed were the research method and design used together with the ethics of research. The data collection and analysis

techniques were discussed with processes on how I ensured the reliability and validity of the study. In Section 3, I provided an overview of the study, presented my findings, discussed the applications to professional practice, and recommendations for action. I concluded with recommendations for further research, reflections, and the conclusion.

Section 3: Application to Professional Practice and Implications for Change

In this section, I presented my findings for this qualitative study and how the identified themes related to professional practice. I then compared them using the RBV as the conceptual framework. I provided implications for social change and included recommendations for action. I then finished up with recommendations for further study, reflections, and the conclusion.

Overview of Study

The purpose of this qualitative single case study was to explore strategies used by NAs deployed for disaster relief operations to recover from SATCOM failures. The data sources were semi-structured interviews and privately held network monitoring statistics of the partnering organization. The population of this study was NAs working in a large government organization. An important criterion for participants was that they had experience working in Level 3 emergency environments where there were elevated requirements to keep IT systems operational. I used the RBV as the conceptual framework. Coding was performed using a Microsoft Excel spreadsheet through which themes were identified.

Presentation of the Findings

In this study, I sought to answer the overarching research question: What strategies are used by NAs deployed for disaster relief operations to recover from SATCOM failures? I conducted semi-structured interviews with nine participants and performed member checking to validate the data and used purposeful sampling to select the participants. Purposeful sampling allows the researcher to select

specific qualities in participants which ensures that rich data is gathered (Goodrich, 2019).

I performed triangulation using two sources of data: semi-structured interviews and network monitoring statistics that were provided by the partnering organization. These statistics which covered 12 months were: network availability, packet losses, bandwidth utilization, and latency, and gave an indication of the performance of the SATCOM links. Coding was performed using a Microsoft Excel spreadsheet out of which three dominant themes emerged: (a) redundancy which referred to the availability of alternative telecommunication links for information to flow, (b) knowledge which was acquired through formal and informal training, and (c) spare parts which were required to replace damaged or faulty parts of the VSAT. Additionally, three minor themes emerged: (a) conflicts which were due to civil unrest, (b) vendor support which referred to technical skills from an external party who performed corrective and preventive maintenance, and (c) communication which referred to the communication between the NAs and the ISPs, senior management, Supply Chains, Logistics and Administration teams. The RBV also served as a guide to identify resources that were valuable, rare, inimitable, and non-substitutable.

My findings showed that the setting up of redundant networks was the primary strategy used to recover from SATCOM failures. The other strategy was the application of knowledge in VSAT maintenance that was acquired formally by NAs, and informally by nontechnical staff who were not in the IT department. The

third strategy was the availability and the processes followed to acquire spares that were used to replace or repair malfunctioning parts of the VSAT. All participants overwhelmingly endorsed the use of redundant networks to recover from SATCOM failures.

Theme 1: Redundancy

The first theme identified in this study was the use of redundant networks to recover from SATCOM failures. Redundancy in networks is used to improve the availability of a system by duplicating a device or a network (Yan, Lu, & Li, 2018). The redundant device or network can perform 2 roles. If the active device or network is unavailable, the duplicated device or network takes over the function of the active part; or the active device or network can function concurrently with the redundant part. The study findings showed that in all instances, the SATCOM links played both roles in redundancy. They were used as backups to carry communication traffic in case of a failure of terrestrial communication networks, as well as concurrently shared the communication traffic with terrestrial links.

The underlying reason for using the SATCOM links for backups was that they had a higher latency, were more expensive to maintain than local terrestrial Internet Service Provider (ISP) connections, and were available when there was a failure in the terrestrial network. According to Participant 9 (P9), “The VSATs are reliable. I mean, we hardly ever have a problem with them from my experience.” P9 further commented that “The cost for megabit bandwidth on the VSAT is extremely high.” Participant 2 (P2) agreed and also commented that “We are using

VSATs which are very expensive for us, but we don't have a choice." Continuous access to the Internet and corporate resources were essential to the overall operations at the locations where the NAs worked. The provision of telecommunication services in emergency environments are typically complementary terrestrial and satellite networks which should provide connectivity on demand (Das, Panda, Sen, & Arif, 2019). Table 5 shows the frequency of occurrence of the theme, redundancy.

Table 5

Frequency of First Theme, Redundancy

Major/Minor Themes	Participant		Network statistics	
	Count	References	Count	References
Redundancy	8	52	9	12
Civil Unrest/Conflict	7	28	9	12

Participant 1 (P1) indicated that their Internet connections through the local ISPs were not stable, and they had to rely on the VSAT when there were outages. P1s assertion was backed by the network monitoring statistics which showed that the downtime of the VSAT was 16 hours over a 12-month duration. In comparison, the terrestrial connections had a total downtime of 130 hours for that same duration. Seven participants had a combination of VSATs and terrestrial ISPs; Participant 3 (P3), Participant 4 (P4), Participants 5 (P5), Participant 6 (P6), Participant 7 (P7), Participant 8 (P8), and P9. They all agreed that the VSATs were

more reliable than terrestrial ISPs. P2 was solely dependent on VSATs as a primary and secondary connection which usually occurs in locations that are remote from any reliable terrestrial ISP connections. In such situations, the use of SATCOMS becomes a mandatory requirement if any viable form of communication is to be supported (Kapovits et al., 2018). Due to the use of 2 VSATs, P2 commented that they were assured of data continuity irrespective of whether there was a hardware or software problem on any of their VSATs. Over 12 months, the downtime recorded by the primary VSAT was 2 hours, and the secondary was 46 hours. With the exception of P5, all the other participants indicated that they had mobile satellite service (MSS) terminals available as a last resort in the event of a failure. However, these were rarely deployed due to the prohibitive cost of the service.

The use of redundant networks was consistent with several parts of the literature. Due to the importance of the SATCOM link in the event of a failure of the terrestrial links, it was monitored constantly to ensure that it had sufficient capacity to support any surge in demand from the users in the humanitarian operation. Xu, Chen, Jansuwan, Yang, and Ryu, (2018) pointed out that when setting up a redundant network, the capacity and available alternatives should be considered in the design. According to Miranda, Molinaro, and Razafindralambo (2016), when a disaster damages some telecommunication infrastructure, there should still be some connectivity available to support the first responders.

P1, P2, and P9 indicated that due to the high cost of maintaining their SATCOM links they preferred to use them as backups. In that state, the SATCOM links were used to carry minimal communication traffic but were capable of expanding their bandwidth when there was higher demand. The trend observed in all sites that had terrestrial ISPs was that the capacity of the SATCOM links was smaller than those of their terrestrial links. At the locations of P1, P3, P4, P5, P6, P7, and P8, their SATCOM links carried communication traffic with minimal packet losses when there were prolonged outages on their terrestrial links. Over a 12 month period, the aggregate of the packet losses of all the participants was 1.42%, whereas the aggregate packet losses of their terrestrial ISPs were 4%. As a result, it was reasonable to deduce that the capacity was selected to support the minimum communication traffic that each location needed if their terrestrial connections failed.

To enhance the reliability of their terrestrial links, P9 commented that they insisted that their ISP had redundancies built into their network. As a result, their ISP had additional upstream connections to the Internet which improved the availability of the service. A comparison of the month with the lowest VSAT availability to the lowest terrestrial link availability indicated that the terrestrial link had an availability of 99.82%, which translated to 77 minutes of unavailability in a month. With the network monitoring statistics received from the partnering organization, the availability was calculated as the percentage of the duration that the SATCOM service was available in a month. For example, for availability of

99.95% in the month of June, meaning the service was available for 29.9 days of the month. The duration that the service was unavailable also translated to 21 minutes within the month.

Due to civil instability and conflicts in the locations where the participants worked, they ensured that they had functional strategies to recover from SATCOM failures. P3 and P7 indicated that in addition to constant civil unrest, they had to contend with droughts, support for refugees, and internally displaced persons which required communication over their SATCOM links. Redundant systems reduce the possibility of chain reactions that can have a higher toll in emergencies (Cimellaro, Arcidiacono, & Reinhorn, 2018). P8 commented that there were malicious incidents where the fiber optic cables providing Internet services to their premises were deliberately cut by unknown parties. As a result, they resorted to microwave links and the VSAT connection to ensure that there was continuous connectivity to the Internet whenever the fiber optic connections were disrupted. Even though P8 could not recollect exactly when there were cuts to their fiber optic connection, the network statistics showed that the VSAT effectively supported the traffic because the packet losses were less than 1% during periods of prolonged outages that ranged from 1 to 4 days. P6 pointed out that the ISPs had their facilities damaged during the peak of a civil war which had impacted the stability of the Internet services they received from the ISPs. Even though the ISPs were currently rebuilding their switching centers a review of the statistics for P6

indicated that the terrestrial links were significantly unstable which resulted in an aggregated downtime of 26 days over a 12-month duration.

There were two mentions of satellite frequency interference. P1 indicated that they had terrestrial ISP connections in place for redundancy purposes due to the jamming of their satellite frequencies at intermittent periods. Their statistics indicated that there were periods of severe packet losses which reduced the availability of the VSAT compared to the terrestrial link. From the literature, even though SATCOM links can operate in a degraded manner (Wilk-Jakubowski, 2018), a displacement of the antenna can be used to reduce the effect of interference (Abdulrazak & Hameed, 2014). But this was not an option in this case where the statistics showed that the potential interference was intermittent and that P1 did not have the space to relocate their equipment. P8 abandoned a bandwidth upgrade because satellite frequency interference could not be isolated. P8 also pointed out that they had limitations of space and movement, and even with the intervention of the service provider, they were unable to surmount the problem.

The networks depicted by the participants in this study were similar to the hybrid satellite-terrestrial network depicted in Figure 1. The difference between the networks were that the participants had their communication traffic balanced across a parallel system which was equivalent to a redundant network. The benefit was that there was always connectivity on demand when any one of the ISPs or VSATs had an outage. Miranda, Molinaro, and Razafindralambo (2016) argued that a redundant system must operate in real-time and be based on demand.

Feedback from all of the participants was consistent with the literature on redundancy. P4 indicated that the redundancy ensured that there was no breakdown in communication even when there was a failure in a component of the VSAT. P6 agreed and indicated that in addition to ensuring that their networks were redundant, MSS equipment was primed to be used when all other avenues to restore the service failed. P7 indicated that they also used the global system for mobile communications (GSM) enabled modems supporting connections to the Internet, MSS terminals and satellite telephone handsets. With several options available for backup connectivity, a reasonable deduction was that the loss of connectivity was so important that there could be a ripple effect if an outage was not resolved promptly. The possible ripple effect was consistent with Harrison and Williams (2016) who argued that service disruption can affect personal, social and economic activities.

Even though rebuilding telecommunication infrastructure was an opportunity to scale to meet consumer demands (Bao et al., 2016), in the case of P7, the ISPs rebuilding of the public telecommunication infrastructure reflected negatively on their overall availability, and subsequently their ability to recover from SATCOM failures. Despite the overall 93% availability of the terrestrial links, there were some months where the availability was at par with the availability of their VSAT, indicating that their terrestrial networks can perform efficiently but had some bottlenecks along the path.

The VRIN framework of the RBV supported the strategies at various levels. Since the strategies used by the participants under this theme were characterized by hardware placement, the RBV was not ideally suited to assess their value. Tangible resources can be acquired by any other organization and therefore do not present an exceptional value (Barbosa, Vicente, Ladeira, & Oliveira, 2017). While the possibility of obtaining an exceptional value was grounded in identifying VRIN resources, the resources had to be combined in different measures to create competitive advantages (David-West, Iheanachor, & Kelikume, 2018). In circumstances where hardware was considered under the RBV, the value was rather in the decisions, information, and knowledge that could be acquired from the resource (Barbosa et al., 2017). While, the effectiveness of decisions due to information flow could be classified as a resource (Cao, Duan, & Cadden, 2019), the information must also be controlled before the tangible assets can be considered in the VRIN framework (Ausrød, 2017).

Seven out of nine participants indicated that there were civil conflicts or local insecurities that made them ensure that they had strategies in place to recover from SATCOM failures. In conflicts, disaster-relief operators assign high priority to data communication services and are prone to diverting resources to minimize disruptions (Das, Panda, Sen, & Arif, 2019). Since the environments where the participants operated were fraught with civil unrest, it was reasonable to deduce that there was significant information flow. Essentially, the information generated and moved across the network was a valuable resource.

There was a gap in the ability to resolve satellite frequency interference in emergency locations due to limitations on movement and space. Prior literature by Harris III (2014) also indicated that there were increased risks of interference to satellite operations in orbit due to overcrowding by several other satellites and debris. The inability to resolve frequency interference affects access to resources and can expose a system to risk due to malfunctioning parts (Lambakis, 2018). In conjunction with their management teams, the participants had to make decisions whether there was economic sense to invest in the movement of equipment in situations where the interference was sporadic. The RBV was not entirely compatible with this situation, because the resources available to resolve the interference appeared to be disproportionate to the task in that environment.

However, drawing from both the RBV and the dynamic capabilities theory (DCT), there were possibilities to combine their IT capabilities with innovative ideas to resolve the interference. The dynamic capabilities of a firm consider the ability to adapt their resources to changing circumstances (Yoon, Kim, Vonortas, & Han, 2017). In a study to improve export performance in a rapidly changing market, it was found out that the changing market conditions shaped the strategic posture of IT (Racela & Thoumrungroje, 2019). Essentially, while the IT administrators were cognizant of the possibilities of interference, they proactively had mitigation systems in place to reduce the negative impact. However, there were opportunities to derive from the status quo; in that, management-backed learning across different resources could produce multiple temporary solutions

(Oliver, 2018). Additionally, drawing from the RBV, the knowledge derived out of adapting to changes in these dynamic environments can align with the VRIN framework. Some benefits are the knowledge acquired through understanding and following through with a systematic verification and elimination of causes of interference to arrive at a conclusion.

Drawing from the RBV in a study on digital financial services, two technological constraints stood out to providing reliable financial services; the quality, and the reliability of the telecommunication links (David-West et al., 2018). Looking through the lens of the RBV would imply identifying the resources that were of good quality and were reliable to support the communication requirements of the participant's offices. Telecommunication networks are prone to wear and tear, need to be upgraded, and can take time to repair when there is a failure (Abed et al., 2017; Iyer & Singh, 2017). Since carrier-grade telecommunications was not the typical function of the partnering organization in this study, a partnership was appropriate to meet the demands for maintenance that was beyond the skills of the participants. All the participants mentioned that they used an external vendor for maintenance of their VSATs which was consistent with the PBV in the literature. The PBV as a conceptual framework considers the use of external partnerships and specific practices which increases the possibility of eliminating constraints (Brito & Sauan, 2016).

Theme 2: Knowledge

The second theme identified was the value and use of knowledge acquired by non-technical staff to assist in recovering from SATCOM failures. Participants repeatedly indicated that training was as one of the important strategies used. P5, P6, and P9 indicated that they regularly participated in annual training camps which kept the SATCOM knowledge of their IT staff refreshed and ready to respond to failures. The participation in regular SATCOM training camps was consistent with Bulinska-Stangrecka, and Bagienska (2018) who argued that sustainable staff development practices increase the ability to respond to a crisis. Furthermore, training enhances a knowledge base, and the practice of sharing that knowledge are keys to performance improvement (Caloghirou, Giotopoulos, Korra, & Tsakanikas, 2017; Malik & Kanwal, 2018). There was evidence of such sharing practices in this study, but with mixed outcomes as to the actual use of the knowledge acquired. Table 6 shows the frequency of occurrence of the theme, knowledge.

Table 6

Frequency of Second Theme, Knowledge

Major/Minor Themes	Participant		Network Statistics	
	Count	References	Count	References
Knowledge	8	48	9	12
Formal Knowledge	6	22	9	12
Informal Knowledge	2	5	9	12

There was evidence of the participants informally sharing their knowledge in SATCOM with a non-technical staff at their locations. P2 commented that "We usually try to provide some basic training to staff on site when we go there for routine visits and maintenance." With this knowledge, non-technical staff could help in some basic troubleshooting when needed. P3 agreed but indicated that obtaining non-technical staff to assist was dependent on their interests in the technology. Even though the statistics were not explicit in identifying the use of non-technical staff to resolve outages, reasonable deductions could be made from the performance of the VSATs over a 12-month period. For P2, the availability of SATCOM services in one of their locations that did not have skilled NAs on site averaged 85% and ranged from 44% to 100% for P3. These availability figures were low for operational efficiency, but both participants indicated that those locations were totally dependent on generators for electricity. For example, an availability of 44% translated to uptime of about 13 hours every working day, so obviously some load shedding was taking place. Furthermore, the packet losses recorded over the SATCOM links during those periods were less than 1% in most instances, which was a satisfactory performance indicator. As a result, the informal knowledge that was applied had long-term performance benefits.

The scope of this study did not extend to reviewing the curriculum of in-house training, but this evidence points to informal training that can be categorized under two types of learning; problem-based and visualization-based learning (Wang et al., 2018), and learning-by-doing (Basu, Jain, and Hazra, 2018).

Problem-based learning is a process of acquiring knowledge by solving a problem and is difficult for novices to assimilate the information on the subject. However, when combined with visual-based learning, trainees can enhance their understanding of systems and use that knowledge to resolve problems (Wang et al., 2018). These non-technical staff had visual access to the working system, and with adequate descriptions, could efficiently assist in SATCOM recovery efforts. Basu, Jain, and Hazra (2018) argued that learning-by-doing as a process where trainees became familiar with the product by working with it. It was an expensive venture to begin with, but cumulatively reduced the cost of production. Furthermore, the outcomes of learning-by-doing can increase in-house skills and foster innovation (Ojha, Struckell, Acharya, & Patel, 2018).

Learning and knowledge have the potential to improve the performance of a firm. In a study of the driving factors of innovation, Yoon, Kim, Vonortas, and Han (2017) argued that organizational learning enabled organizations forecast their performance, and subsequently promoted innovation. A firm that can adapt to dynamic business environments can successfully share the knowledge acquired internally, which can also introduce innovative solutions (O'Reilly & Robbins, 2018). Given the potential benefits of learning, there was an opportunity to leverage informal training to become a culture in the organization. Specialized skills can be acquired through on-the-job training which includes using the experienced personnel to train the inexperienced personnel in a firm (David-West et al., 2018). The investment in technology may not significantly improve

performance as compared to the investment in training and developing skills (Yang, Xun, & He, 2015). While infrastructural investment had already been executed in this study, there was an opportunity to divert further investment into upgrading the skills of staff. These investments do not have to be extensive but can rather be encouraging collaboration and coordination (Andersén, 2019).

Participants in areas that had elevated levels of civil unrest and restrictions to their personal movement had an intimate knowledge of SATCOM systems, were more expressive about the need for training, and were committed to formal training. According to P9, “We have multiple people trained across the country, that are ready and available to provide that support and assistance.” For this participant, there was evidence of a stable network from the network statistics due to the presence of trained personnel. Over a 12-month duration, the VSATs in 3 locations had an availability of 99.70%, comparable to what prevailed in other locations. P1 pointed out that personnel who had attended the corporate training sessions were confident in how to change the hardware parts, and that they were able to replace any faulty parts from their stock of spares. P1 indicated that the knowledge of different wide area networking technologies like microwave radios and lasers, coupled with strong lines of communication with the satellite service providers teleport provided a good strategy to recover from failures. The availability of the VSAT for that location was 99.82% which was comparable to other locations, given that they also had to contend with power outages.

Participants in locations that did not have such elevated levels of civil unrest and restrictions to their personal movement were not as expressive of the need for training, even though they did indicate that there was a need for training. P4 fell into this category, and a review of the performance of the VSAT indicated availability of 42% for the VSATs. However, this low figure could not be confirmed as accurate since P4 had pointed out that generators were the sole source of electricity, and it was possible that the equipment was powered down after working hours. P5 already had SATCOM knowledge and indicated that being proactive and identifying what can be fixed before escalating any problem was an effective strategy. The availability of the SATCOM link in use by P5 was 99.39%.

P6 indicated that with basic knowledge on how the system works, they were able to identify problems which were helpful when communicating with the service provider. Furthermore, with basic training, they were better equipped to assist in remote troubleshooting with the vendor. According to Mahdi, Nassar, and Almsafir, (2019), in-house knowledge retention and development are required to maintain a sustainable competitive advantage. For P6, there were two months of prolonged outages recorded over 12 months, there was no opportunity to determine the circumstances of these prolonged outages, but these could indicate two things; either the issue was not surmountable with the skills available, or some equipment was needed which was not immediately available. P3 supported the need for training by indicating that knowledge was required to troubleshoot and use the equipment. Furthermore, P3 commented that telecommunication skills, installing,

troubleshooting, and the deployment of telecommunication equipment was necessary strategies to recover from SATCOM failures. P7 was also in agreement and commented that "We have had to replace the low noise block amplifier (LNB), the polarizer, or the feedhorn" which demonstrated knowledge of how the components of a VSAT were assembled. P7 had a 100% availability for their VSAT for 7 consecutive months which indicated that the strategies they had were effective for that duration.

Technical support from the service provider was a theme running throughout the study. All the participants indicated that the knowledge applied by outsourced technical support was a strategy to recover from a failure. Outsourcing can be a means of reducing risk based on a company's limitations (Espino-Rodriguez & Ramirez-Fierro, 2018). P4 was solely dependent on the service provider for preventive and corrective maintenance. Preventive maintenance occurs when a system undergoes a routine inspection to fix any issues that could lead to faults, and corrective maintenance occurs when a system breaks down, and skilled persons are assigned to repair the system. Additionally, P4 pointed out that, the provider was contractually bound to respond to a failure within an agreed timeframe. Based on the average availability of 42% over a 12-month duration, the location was operational for approximately 10 working hours each day. Since the maintenance hours were 0, it was reasonable to deduce that the VSAT service was acceptable compared to the other locations that did not have timely access to vendor support. However, these figures were inconclusive due to missing

information on the packet losses that occurred for 4 months out of the 12-month duration

P6 indicated that the technical support from the vendor was sparse in some locations and could be improved. However, when the participant was able to identify a component of the VSAT that had failed, the vendor was able to intervene, albeit, not always according to schedule. On the other hand, remote technical support was available to resolve any problems that did not require an on-site visit by skilled personnel. The direct impact could not be verified from the statistics, however, there were two separate months where there were three and six days of downtime. The prolonged outages could mean a breakdown requiring spares or the need for technical support that delayed in arriving. P3 agreed and pointed out that the remote support available reduced the need to send someone on site. All the participants indicated their dependence on the vendor for technical support, with some mentioning that it was based on contractual obligations with the service provider.

It was evident that the participants found the alliance between themselves and the SATCOM service provider valuable. The motivation for an alliance should be based on the need to acquire or integrate resources, the resources the partner can offer, and whether to create or capture a competitive advantage (O'Dwyer & Gilmore, 2018). The model used to provide service as described by P9 was consistent with an on-sourcing model discussed by Howe-Walsh, Turnbull, and Budhwar (2018), where local skilled resources were used to provide a service

instead of hiring these skills across the border. While in the immediate term, there was no evidence of the effect in recovering from a SATCOM failure, there were long-term benefits in sustaining a level of availability.

Even though the RBV considers the use of heterogeneous and immobile resources (Mitra, O'Regan, & Sarpong, 2018), there were some challenges when applying it to the value of the knowledge acquired. Prior literature indicated that the RBV was weak in coordinating in-house skills with production (Grant, 1996), and VRIN resources cannot persist over time in a dynamic environment (Truyens, De Bosscher, Heyndels, & Westerbeek, 2013). As a result, there was the possibility of misidentifying these resources and knowledge in the dynamic environments where the participants operated. In that respect, the knowledge-based theory (KBT) was a viable alternative to harness knowledge, assets, collaboration, and decision making (Grant, 1996). Additionally, the investment in an internal pool of talent and knowledge would be a viable path to follow to improve the performance of a firm (Sung & Choi, 2016).

Sharing of knowledge goes beyond transferring information, to a culture of working together to solve problems (Hsieh, Chen, & Liu, 2019). It is out of these in-depth collaborations that tacit knowledge can be knowingly or unknowingly transferred (Pérez-Luño, Alegre, & Valle-Cabrera, 2018). Since knowledge is an integral resource of a firm (Bignami, Mattsson, & Hoekman, 2019), the knowledge-based theory (KBT) was a natural complimentary framework to support the RBV. According to Song, Yu, and Qu (2018), firms that consider employees as

partners and involve them in work processes could improve the sharing of knowledge and enhance efficiency. However, the context, as well as internal and external factors influence the success of this kind of knowledge (Corsi, Prencipe, Rodríguez-Gulías, Rodeiro-Pazos, & Fernández-López, 2018). Some of these were mentioned by the participants as the absence of key personnel at critical moments, infrastructure spares that were impossible to obtain in certain environments, and managerial buy-in which ensured commitment to training schedules.

There were several points of alignment with the RBV when applying the KBT. In a study of knowledge resources and their effect on competitive advantages, it was found that there were no significant cost savings with investment in technology compared to the application of knowledge (Karia, 2018). To obtain tangible benefits, the knowledge must be aligned with the organizational vision and should be integrated into a knowledge base (Zhu & Li, 2018). The KBT was helpful in identifying other opportunities for collaboration by considering external parties which was consistent with Mohiuddin, Rashid, Al Azad, and Su (2018) who argued that, the use of internal resources and the use of offshore skills could enhance the knowledge base but needs to have strategic value. According to Li (2018), expanding the local knowledge base to include external knowledge inflows, could result in innovative solutions. P1, P3, P7 and P9 indicated that there was some level of collaboration with other organizations that performed similar functions in disaster-relief. The collaboration was limited to providing technical support for failures, or the sharing of their office connections to the ISP which

reduced the overall cost of the service. However, there was no indication of sharing of knowledge in these collaborations which would have strengthened the knowledge base of the organizations involved.

Informal knowledge had VRIN characteristics. Due to the interactions with NAs who were skilled in SATCOM, there was the potential to impart tacit knowledge which was a valuable resource. The visual learning the non-technical staff was exposed to by the skilled staff was consistent with Wang, Yuan, Kirschner, Kushniruk, and Peng, (2018) who argued that the combination of visual learning with expertise improved problem-solving techniques in the trainees. Even though it is difficult to identify and record tacit knowledge, the more there are interactions between persons in a dynamic environment, the more likely there would be a transfer of tacit knowledge (Pérez-Luño, Alegre, & Valle-Cabrera, 2018; Toye, Sheppard, & Chen, 2016). Furthermore, when tacit knowledge can be identified and cataloged into a knowledge repository, it can be classified as an internal resource which aligns with the RBV (Mahdi, Nassar, & Almsafir, 2019). In the remote locations where these non-technical staff had informal knowledge, it was reasonable to deduce that their skills were inimitable and non-substitutable because they were the only persons on site who had some level of knowledge in SATCOMs. Olszak, Bartuś, and Lorek (2018) described inimitable and non-substitutable resources as resources that can neither be copied nor replaced easily. In effect, the informal knowledge acquired by non-technical staff was VRIN and in

alignment with the RBV, and subsequently contributed significantly to efforts to recover from SATCOM failures.

Theme 3: Spare Parts

The need for spare equipment to replace faulty or damaged parts of the VSAT was the third theme identified from the interviews. In reference to importing spare parts for a VSAT, P9 commented that "because everything was being shipped in, it might take a week, it might take three weeks, one month, whatever it takes, we had to wait that time." P3 agreed and commented that "there's no specific period, it's just random. If you're lucky, it takes one week." P3 pointed out that there had been the need to replace a block upconverter (BUC) some months previously and that there were lengthy delays with the delivery. A review of the statistics indicated that the availability averaged 22.30% for 3 consecutive months. Even though P3 was dependent on generators which ran only during working hours to power the VSAT, it can be inferred that the BUC was performing below the manufacturer's specification and the delivery took an exceptionally long time. The unavailability translated to 24 weeks where the SATCOM connection was not performing optimally. Table 7 shows the frequency of occurrence of the theme, spare parts.

Table 7

Frequency of Third Theme, Spare Parts

	Participant		Network Statistics	
Theme	Count	References	Count	References
Spares	7	28	6	12

The participants indicated that there were hindrances to receiving VSAT spare parts in all their locations. Some of the challenges described were due to regulatory control, inadequate spare parts on site, and long shipping timeframes even when the equipment were available. Given that disaster-affected populations need rapid interventions which need available services (Sabouhi, Tavakoli, Bozorgi-Amiri, & Sheu, 2018), human influence was evident in these discussions, especially in the locations where there was civil unrest. In locations where there were travel restrictions, P1 made use of NAs in other humanitarian organizations that were operational close to their remote premises to replace parts on their VSATs. P1 did not provide details of the scheme used by the service provider to supply spare parts. However, the process showed that there was offshoring of equipment by the provider since they had to import equipment at a point in time. According to Sharifyazdi, Navangul, Gharehgozli, and Jahre (2018), if relief items are properly pre-positioned off-shore or on-shore, efficiency can be improved.

Off-shore and cross-border purchases can be problematic, especially where time is of the essence. According to P5, “timing is the greatest enemy in this context.” P5 pointed out that at a point in time, there was a problem which needed support from the vendor, and even though the maintenance was eventually performed, the availability for that month was 95% which was at variance with the rest of the months of the year which were 99% and above. Lorentz, Kumar, and Srai (2018) argued that the control of the distance between the source and destination is a challenge to making international supply chains effective. Some of these elements include regulations, markets and suppliers which need to be combined in unique measures if the procurement process is to be sustainable (Agarwal, Giraud-Carrier, & Li, 2018; Chacón Vargas, Moreno Mantilla, & de Sousa Jabbour, 2018). These complications are consistent with the argument of Jajja, Chatha, and Farooq (2018) who posit that supply chain risks can be mitigated where strong relationships between the customer and supplier can produce agility in the procurement process. P1 persisted in getting regulatory approvals to acquire spare parts on site which took several months. An elaborate process was described where a dedicated team was involved in every step of the process to get regulatory approval, ordering and delivering spare equipment.

I found several points of consistency with a study by Chen, Liang, and Yao, (2018). They argued that when the beneficiary purchases partial equipment to store on site, the supplier can be vested in pre-stocking the additional spares which essentially reduces the time to deliver. There are three inputs that can be used to

achieve an optimum response; proactive insourcing, reactive outsourcing, and monitoring (Yao, Huang, Song, & Mishra, 2018). In the instance of P1, there was a combination of insourcing by the participant and outsourcing by the service provider which enabled the importation of equipment, albeit, regulatory control caused extensive delays. Furthermore, if the cost of monitoring stocks is low in supply chains, hardware should be proactively sourced internally and reactively sourced externally (Yao et al., 2018). Even though supply chains can be replicated, thereby diminishing alignment with the RBV (Yu, Chavez, Jacobs, & Feng, 2018), the tacit knowledge acquired is valuable to a firm since it can be used to make critical decisions in the procurement process (Olszak, Bartuś, & Lorek, 2018).

Strong relationships mirror the RBV where the combination of internal and external resources can create efficiencies that result in competitive advantage (Delery & Roumpi, 2017). P1 pointed out that the importation of VSAT equipment required the coordination of multiple resources. Some of this included coordination with the vendor, governmental protocol, supply chains, and logistics personnel. Comparing the availability of the top four participants who were vocal about the need for spares, P1 had a strategy, did not have any prolonged outage over 12 months, and had an aggregate availability of 99.82%. P2 did not have a strategy but had an aggregate availability of 99.57%. P5 did not have a strategy and had one month where the availability was 45%. P6 did not have a strategy and experienced 2 months where the availability fell below 90%. While these figures were inconclusive as to whether the low availability was due to the lack of spares, the

fact was that the VSATs were not operating optimally over a certain duration due to some internal or external factors that were beyond their control.

Out of the interviews, I identified drivers and enabling factors working in tandem that supported the efficient procurement process. Drivers are guidelines that dictate the direction a process should take, and enablers are the tools used to follow the processes (Danese, Lion, & Vinelli, 2018).

Figure 7. Drivers and Enablers Working in Tandem

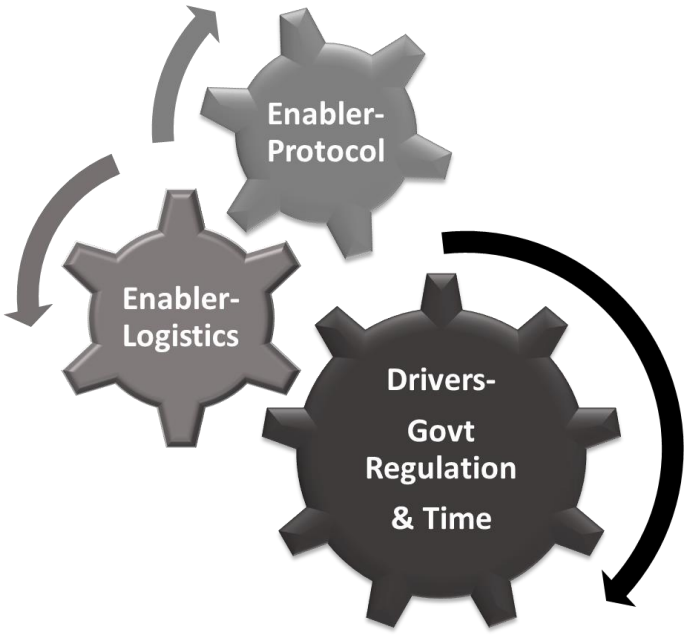

Figure 7. Drivers and Enablers Working in Tandem.

Governmental regulation and time as drivers. Time and governmental regulation were identified as the main drivers behind the procurement process. Since the lead times to deliver equipment were relatively long, and regulatory compliance was a time-consuming process, the timely delivery of VSAT spares

was hampered. Given that this study was conducted in countries that were experiencing level 3 emergencies, and had some political instability, the status quo had a debilitating effect on the importation process. Political instability can have a negative ripple effect on the policies that govern supply chains, (Wong & Tang, 2018). An option was to use green supply chain management (GSCM) which is an environmentally sustainable way of supply chain management. Even though the GSCM concept is still in development, Tseng, Islam, Karia, Fauzi, and Afrin (2019) argued that the practice of GSCM uses governmental policy to encourage collaboration between members of the supply chain to implement sustainable supply chain practices.

Parallels can be drawn to the scenario of P1, where regulatory compliance required the collaboration between various sections of the supply and logistics chain. König, Caldwell, and Ghadge (2018) argued that, in addition to cross-border exportation of goods being implemented under highly integrated services, firms also strive to increase their tacit knowledge to improve lead times. When the RBV concepts were compared to governmental regulations, it was apparent that the regulations were beneficial in that they encouraged collaboration among the stakeholders. However, it was the tacit and intimate knowledge of these regulations being applied across the supply chain, which determined the sustainable strategy of importing the spare parts for the VSATs.

Logistics and protocol as enablers. There were requirements for a balance between providing timely logistical support and adhering to government protocols

to meet delivery timeframes. Unstable environments are prone to rapid changes in circumstances that can affect logistics and lead-times (El Meladi, Glavee-Geo, & Buvik, 2018). To accommodate rapid changes, the logistics team must anticipate, and be sufficiently agile to manage the threats or risks (Ahmed & Huma, 2018). While it was important for an organization to present a united front to anticipate risks or threats to the importation process, reactive efforts to quell risks are not as effective when implemented in isolation (Gouda & Saranga, 2018). From the RBV perspective, internal attributes that can neutralize threats in a specific environment can be considered as resources (Barney, 1991). One of these attributes was the knowledge of the teams handling the supply chain and logistics processes. The skills and knowledge in the procurement process were developed out of this instability and produced a competitive service when compared to other organizations that operate in stable environments. According to Coetzee and Van Niekerk (2018), in the absence of risks, there is a reduced opportunity to learn, adapt and build resilience to shortages.

Through the RBV lens, Welsh, Kaciak, and Shamah (2018) argued that human capital was the most important resource in hostile environments and that each country must be considered in its own context. Furthermore, the RBV depends on intangible assets to assess competitive advantages (Mahdi, Nassar, & Almsafir, 2019). Specialized knowledge could be duplicated by any other organization, and subsequently, does not strictly meet the metrics of the RBV. The dynamic environment was addressed with the DCT which delves into the

classification of resources based on capabilities that can still provide a competitive advantage (Teece, 2014). Three resources of the RBV can be mapped to three resources of the DCT. IT technology, IT relationship, and idle resources can be mapped to the three DCT capabilities; IT technology capabilities, compatibility, and strategy flexibility (Shan, Luo, Zhou, & Wei, 2018).

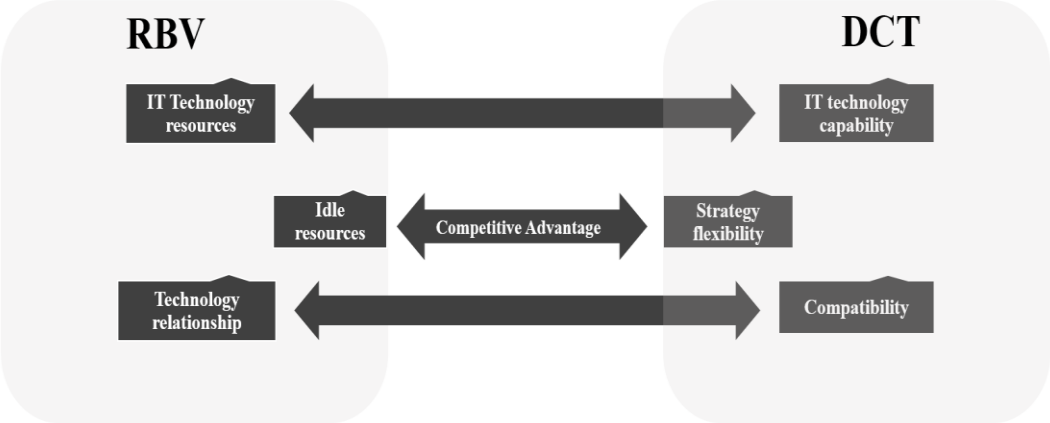

Figure 8. Relationships between RBV and DCT to achieve a competitive advantage. Adapted from "Big Data Analysis Adaptation and Enterprises' Competitive Advantages: The Perspective of Dynamic Capability and Resource-based Theories," by S. Shan, Y. Luo, Y. Zhou, and Y. Wei, 2018, *Technology Analysis & Strategic Management, p.* 1–15.

The main difference between the two frameworks were the idle resources from the RBV which mapped to the strategy flexibility. Strategy flexibility is being cognizant of the customer's requirements when developing a strategy (Sundqvist, 2018). Idle resources can act as a buffer for unforeseen events but can also become

a liability if there is no planned use over a prolonged period (Moradi & Shadrokh, 2018). The mapping process is dynamic, in that, a firm cannot meet its responsibilities when there is a shortage of materials (Shan, Luo, Zhou, & Wei, 2018). Therefore, constant attention to, and anticipation of the needs of the firm must be at the forefront of acquiring idle resources. P1 was efficient in the recovery from SATCOM failures because they pre-stocked equipment (idle resources), which subsequently enabled efficiency and flexibility in their recovery strategies.

Using the RBV there were opportunities to identify resources that could be used sustainably to achieve a competitive advantage. Beneficiaries of supply chains tend to use more sustainable resources in their practices (Ghadge, Kidd, Bhattacharjee, & Tiwari, 2018). Governments can influence the sustainability of these resources by creating an enabling environment for them to be effective (Wong & Tang, 2018). However, bureaucracy and customs processes have led to the off-shoring of portions of the supply chain to reduce risk (Hansen, Mena, & Aktas, 2018). A similar environment persisted with the participants, where the acquisition of spares was outsourced to an external party. P6 stated that "We are not in full control of the entire process." While the use of external resources does not fall strictly within the RBV, the combination of physical, human and organizational resources in measures that cannot be replicated create a valuable resource (Barney, 1991). In line with the RBV, multiple resources can come together to produce competitive advantage, but the challenge would be how to combine them in sufficient measures to ensure they are sustainable.

When considered in the context of the RBV, the availability of spare parts did not completely fulfill the VRIN requirements because they were fundamentally a commodity which could be purchased by any other organization. Resources that meet the RBV requirement must simultaneously be valuable, rare, inimitable, and non-substitutable (Wikhamn, 2019). The knowledge acquired by P1 was complementary in sustaining and the recovery from a failure. According to Mahdi, Nassar, and Almsafir, (2019), in-house knowledge retention and development are required to maintain a sustainable competitive advantage. There were opportunities to improve in the process of importing equipment by collaborating with other humanitarian organizations working in the same country. According to Nolte (2018), when organizations collaborate in the provision of services, the focus should be on developing quality processes as against the timeliness of the process. The benefits can appear in the form of a reliable supply and logistics process, and personnel who will be better equipped with the knowledge and skills to address regulatory policies and protocols.

Applications to Professional Practice

The specific IT problem for this study was to identify the strategies used to recover from SATCOM failures due to the important use of SATCOM in disaster relief operations. The participants provided strategies they adopted in their recovery strategies which were identified around three themes, redundancy, knowledge transfer, and spare parts. All the participants were overwhelmingly

reliant on redundancy using other kinds of telecommunication media as the first line of recovery.

Due to the ever-increasing global emergencies and demands for funding, disaster-relief operations are constantly evolving to ensure resources are used efficiently. Organizations that intend to use SATCOM or who are already using SATCOM require current information on the challenges of maintaining high-performing SATCOM networks. Furthermore, prior knowledge of these strategies will help disaster-relief organizations plan against possible impediments when deploying in new areas. I drew from the RBV which provided a framework to identify resources that were valuable, rare, inimitable, and non-substitutable. The data used were from locations that were actively functioning in disaster-relief operations and reflected the current realities on the ground. Although the strategies may have been widely applied across the industry, the RBV revealed significant gaps where additional resources could be deployed to not only improve the recovery process but also to introduce innovative solutions.

Redundancy was a major theme running throughout this study and was used by the partnering organization to ensure that there was always some form of connectivity. To minimize the recurring costs of the SATCOM links which were expensive, local ISPs should be used to transport the bulk of the traffic, while the SATCOM links should be sized to carry the critical information should the ISP links have a failure. Furthermore, to ensure the SATCOM links were not idle, they should be used in load balancing as well. Since there were no successful mitigation

strategies to overcoming frequency interference, forward-looking options using other forms of telecommunication media were considered. It was especially important in environments where there was some military activity or physical space limitations. Even though the use of local ISPs was recommended, there were perturbations with the service that could persist for significantly extended periods, especially in locations where the telecommunication infrastructure was damaged by civil conflict.

Knowledge acquisition and sharing was another characteristic of the partnering organization. In locations where there was a continuous and consistent investment in training, the SATCOM links had relatively high availability values. In locations that did not have local NAs, the informal transfer of knowledge to non-technical personnel significantly improved the performance of the SATCOM links. The RBV revealed that a culture of intentional collaboration and sharing of knowledge had the potential to significantly improve the performance of the SATCOM links and foster innovative ideas.

The third and final characteristic was the availability of spare parts. There were several challenges in receiving adequate spare parts due to the need for government regulatory approvals, and the logistics involved in moving equipment in disaster-relief areas. Depending on the contractual obligations for the SATCOM service, organizations can pre-stock essential spares at the organization's own cost and the vendor has supplementary stock. The goal was to minimize the cost of

keeping equipment idle, and concurrently having them available for use on demand.

The findings revealed the strategies used by the partnering organization to recover from SATCOM failures. The RBV indicated that there were opportunities to improve the performance of SATCOM links by sharing knowledge. A culture of consistently collaborating and working together within the organization would impart basic knowledge that could improve the skills of personnel. Furthermore, the RBV indicated that it was not the physical assets that were important in the recovery efforts, but the capabilities of the human resource.

Implications for Social Change

Organizations that are preparing for the deployment, expansion, and maintenance of SATCOM networks need to pay attention to this study. There are cost-savings that can be achieved in the sizing of bandwidth for SATCOM communications, vis-à-vis the terrestrial ISPs. As a result, funds can be reallocated towards other areas in the disaster-relief operation without jeopardizing the quality of telecommunication links. Another social benefit can be found in the sharing of knowledge across the network. Key personnel who are trained should share their knowledge and the result could be evident in stable communication links. Such knowledge sharing would be particularly beneficial in organizations that do not have the funds to invest in the formal training of all personnel, and to enable technical support in areas that do not need full-time NAs. Additionally, collaboration and knowledge sharing can introduce innovative ideas that can be

applied in other areas of the emergency. This study will be disseminated to humanitarian organizations operating in similar environments via their heads of departments responsible for emergency telecommunications operations.

This study will be valuable to the Emergency Telecommunications Cluster (ETC), a global network of organizations that provide telecommunication services to humanitarian emergencies (ETC, n.d.). The ETC is committed to deploying to an emergency within 24 hours, and this study could be used to generate or update a checklist of potential hindrances to deployment, and the best practices to ensure a stable network This study will be disseminated to the cluster via their representative in the partnering organization.

This study will be of value to the local ICT working group of the countries where emergency humanitarian activities are taking place. These working groups comprise all the humanitarian organizations in the country who meet periodically to formulate and implement ideas to share resources, reduce the ICT operational costs, and share knowledge on the best practices to support their respective emergencies. The study will be disseminated through the ICT managers of the partnering organization to include in their agenda for subsequent working group meetings.

This study will indirectly have a positive impact on routine humanitarian operations which include the collection and reporting of data which is used to identify weak areas and ascertain the impact of the humanitarian response. As a result, accurate and timely reporting can accelerate the inflow of funds from the

donor community, which can then be redirected into the response to help more people. Services like humanitarian air booking can proceed uninterrupted, ordering and provisioning of goods such as vaccines, educational material, and food for disaster-relief can be accomplished according to schedule.

Recommendations for Action

The partnering organization in this study was operating in several countries across the globe and involved in substantial humanitarian work. With an ever demanding and sometimes hostile environment, these strategies can be used to enhance their agility and ability to adapt to changes. Furthermore, I recommend that IT managers train non-technical personnel in providing rudimentary technical support. In this respect, the skilled IT personnel can channel their efforts into improving the resilience of their networks or get more involved in other areas of applying technology.

Even though the communication structure between the NAs, service providers, supply chain management, and executive management was not tested, I would recommend creating an awareness of the influences of the environment, resources, and affiliations that can impact the outcome when communicating specific needs. Supply chain managers can catalog these processes and a blueprint published as a baseline of best practices for logistical operations in an emergency environment. IT practitioners should review their redundant telecommunication infrastructure by looking for simplification which will enable a more efficient transition between a failed and an operational link. Where there are choices, I

would recommend a review of the redundancy capabilities of their upstream ISPs. Insisting on their implementing redundant capabilities can improve the reliability of the downstream service.

Recommendations for Further Study

Since I cannot generalize the results across the industry, the study can be advanced by performing a quantitative study encompassing a larger number of participants from different organizations in the humanitarian sector. As a quantitative study, it will afford the opportunity to use statistical tools to analyze the data which can give an objective outlook of the causes, effects, and recovery strategies on satellite communication links, or any telecommunication link for that matter. A limitation of this study was the absence of trouble tickets of incidents that occurred within the network. Further studies in that direction can be used to further validate the actions taken in the recovery process and identify the strategies that are consistently applied.

Another area for further study I recommend would be service-provider and client relationships in humanitarian and disaster-relief operations. During the interviews, there were traces of satisfaction and dissatisfaction between the client and telecommunication service providers. In an emergency environment, it would be valuable to know the dynamics of providing services as against the impact these would have on the emergency response. These results could define a path on the best practices of engagement with service providers in humanitarian work.

Since there was relatively little participation from participants located in Asia and the Middle East, a further study including those locations is recommended. The outcomes would validate these findings and indicate whether my results were affected by this limitation. It will also provide a broader outlook of strategies across a wider spectrum of locations working under level 3 emergencies.

Some participants commented on the latency of the satellite links. The latency is due to the use of geostationary satellites (Lourenço, Figueiredo, Tornatore, & Mukherjee (2019). In recent years, low earth orbiting and medium earth orbiting satellites have come into play with relatively low latency (Nag, Li, & Merrick, 2018). I recommend a further study for locations that use this technology in humanitarian services.

Finally, there is room for further study in the direction of importing telecommunication equipment into countries that are experiencing civil unrest. A case study could reveal the challenges and the best practices which could significantly reduce the lead-time.

Reflections

The journey has been a long one where I was challenged with significant traveling and transfer to work in another country over the past year. It worked in my favor since I had the opportunity to experience, firsthand, the impact of IT practice on disaster-relief and humanitarian operations. Even though I made every effort to ensure that I was not biased in the collection and analysis of the data, it is possible that my knowledge of the industry could have unintentionally influenced

the discussions with the participants and my analysis. I have enjoyed the finishing part of this study, especially when I realized how the pieces fell together with the themes, and I am looking forward to applying them in my immediate environment. For IT professionals, these recommendations can enhance their practices, since they may already have similar experiences when working in the field.

Summary and Study Conclusions

Strategies for recovering from SATCOM failures in disaster-relief operations is a multi-faceted effort. It involves communication with multiple stakeholders to ensure precise information is conveyed, the right resources are allocated, and the correct solutions are applied, all happening in a dynamic and fast-paced environment. While in-house capacity and knowledge are enhanced in the process, the emergency environment can also be leveraged to ensure that the stakeholders are heard, and the information dispersed results in social changes.

References

Abdulrazak, L. F., & Hameed, A. (2014). Terrestrial-to-satellite interference in the C-band: Tractable calculation technique. *Journal of Theoretical and Applied Information Technology, 65*(3), 762. Retrieved from www.jatit.org

Abed, F., Chen, L., Disser, Y., Groß, M., Megow, N., Meißner, J., … Rischke, R. (2017). Scheduling Maintenance Jobs in Networks. *Algorithms and Complexity*, 19–30. doi:10.1007/978-3-319-57586-5_3

About ITU. (2019) About international telecommunication union. Retrieved from https://www.itu.int

Adams, C., & van Manen, M. A. (2017). Teaching phenomenological research and writing. *Qualitative Health Research, 27*(6), 780-791. doi:10.1177/1049732317698960

Adler, J. M., Dunlop, W., Fivush, R., Lilgendahl, J. P., Lodi-Smith, J., McAdams, D. P., … Syed, M. (2017). Research Methods for Studying Narrative Identity: A Primer. doi:10.31234/osf.io/cz3q3

Afseth, J. D., & Paterson, R. E. (2017). The views of non-medical prescribing students and medical mentors on interprofessional competency assessment – A qualitative exploration. *Nurse Education Today, 52*, 103-108. doi:10.1016/j.nedt.2017.02.022

Agarwal, A., Giraud-Carrier, F. C., & Li, Y. (2018). A mediation model of green supply chain management adoption: The role of internal impetus. *International Journal of Production Economics, 205*, 342-358.

doi:10.1016/j.ijpe.2018.09.011

Aghazadeh, H. (2015). Strategic marketing management: Achieving superior business performance through intelligent marketing strategy. *Procedia: Social and Behavioral Sciences, 207*, 125-134. doi:10.1016/j.sbspro.2015.10.161

Aguilera-Caracuel, J., Aragón-Correa, J., Hurtado-Torres, N., & Rugman, A. (2012). The effects of institutional distance and headquarters' financial performance on the generation of environmental standards in multinational companies. *Journal of Business Ethics, 105*(4), 461-474. doi:10.1007/s10551-011-0978-7

Agula, J., Barrett, J. B., & Tobi, H. (2015). The other side of rapport: Data collection mode and interviewer gender effects on sexual health reporting in Ghana. *African Journal of Reproductive Health, 19*(3), 111-117. Retrieved from https://www.ajol.info

Ahmed, W., & Huma, S. (2018). Impact of lean and agile strategies on supply chain risk management. *Total Quality Management & Business Excellence*, 1-24. doi:10.1080/14783363.2018.1529558

Ahmed, W., Hasan, O., Pervez, U., & Qadir, J. (2017). Reliability modeling and analysis of communication networks. *Journal of Network and Computer Applications, 78*, 191-215. doi:10.1016/j.jnca.2016.11.008

Alcadipani, R., Westwood, R., & Rosa, A. (2014). The politics of identity in organizational ethnographic research: Ethnicity and tropicalist intrusions.

Human Relations, 68(1), 79-106. doi:10.1177/0018726714541161

Ali, S., Green, P., & Robb, A. (2015). Information technology investment governance: What is it and does it matter? *International Journal of Accounting Information Systems, 18*, 1-25. doi:10.1016/j.accinf.2015.04.002

Allen-Walker, V., Mullaney, L., Turner, M. J., Woodside, J. V., Holmes, V. A., McCartney, D. M., & McKinley, M. C. (2017). How do women feel about being weighed during pregnancy? A qualitative exploration of the opinions and experiences of postnatal women. *Midwifery, 49*, 95–101. doi:10.1016/j.midw.2016.12.006

Alsoghayer, R., & Djemame, K. (2014). Resource failures risk assessment modelling in distributed environments. *Journal of Systems and Software, 88*, 42–53. doi: 10.1016/j.jss.2013.09.017

Andersén, J. (2019). Resource orchestration of firm-specific human capital and firm performance—the role of collaborative human resource management and entrepreneurial orientation. *The International Journal of Human Resource Management*, 1–33. doi:10.1080/09585192.2019.1579250

Arik, M., Clark, L. A., & Raffo, D. M. (2016). Strategic responses of non-profit organizations to the economic crises: Examining through the lenses of resource dependency and resource-based view theories. *Academy of Strategic Management Journal*, *15*(1), 48-70. Retrieved from www.alliedacademies.org/academy-of-strategic-management-journal/

Arriaza, P., Nedjat-Haiem, F., Lee, H. Y., & Martin, S. S. (2015). Guidelines for conducting rigorous health care psychosocial cross-cultural/language qualitative research. *Social Work in Public Health, 30*(1), 75-87. doi:10.1080/19371918.2014.938394

Arrighetti, A., Landini, F., & Lasagni, A. (2015). Intangible asset dynamics and firm behaviour. *Industry and Innovation, 22*(5), 402–422. doi:10.1080/13662716.2015.1064256

Arvidsson, V., Holmström, J., & Lyytinen, K. (2014). Information systems use as strategy practice: A multi-dimensional view of strategic information system implementation and use. *The Journal of Strategic Information Systems, 23*(1), 45-61. doi:10.1016/j.jsis.2014.01.004

Auld, G., Baker, S., McGirr, K., Osborn, K. S., & Skaff, P. (2017). Confirming the reliability and validity of others' evaluation tools before adopting for your programs. *Journal of Nutrition Education and Behavior, 49*(5), 441–450.e1. doi:10.1016/j.jneb.2017.02.006

Aulgur, J. J. (2016). Governance and board member identity in an emerging nonprofit organization. *Administrative Issues Journal: Education, Practice, and Research, 6*(1), 6-21. doi:10.5929/2016.6.1.1

Ausrød, V. L. (2017). It takes two to tango: mobilizing strategic, ordinary, and weak resources at the base of the pyramid. *Journal of Strategic Marketing, 26*(8), 665–687. doi:10.1080/0965254x.2017.1344290

Azevedo, C. L. B., Iacob, M.-E., Almeida, J. P. A., van Sinderen, M., Pires, L. F.,

& Guizzardi, G. (2015). Modeling resources and capabilities in enterprise architecture: A well-founded ontology-based proposal for ArchiMate. *Information Systems, 54*, 235–262. doi:10.1016/j.is.2015.04.008

Azzam, T., & Harman, E. (2016). Crowdsourcing for quantifying transcripts: An exploratory study. *Evaluation and Program Planning, 54*, 63–73. doi:10.1016/j.evalprogplan.2015.09.002

Backman, C. A., Verbeke, A., & Schulz, R. A. (2016). The drivers of corporate climate change strategies and public policy. *Business & Society, 56*(4), 545–575. doi:10.1177/0007650315578450

Bao, N.-H., Habib, M. F., Tornatore, M., Martel, C. U., & Mukherjee, B. (2015). Global versus essential post-disaster re-provisioning in telecom mesh networks. *Journal of Optical Communications and Networking, 7*(5), 392. doi:10.1364/jocn.7.000392

Bao, N., Tornatore, M., Martel, C. U., & Mukherjee, B. (2016). Fairness-aware degradation based multipath re-provisioning strategy for post-disaster telecom mesh networks. *Journal of Optical Communications & Networking, 8*(6), 441. doi:10.1364/JOCN.8.000441

Barbosa, M. W., Vicente, A. d. l. C., Ladeira, M. B., & Oliveira, M. P. V. d. (2017). Managing supply chain resources with Big Data Analytics: a systematic review. *International Journal of Logistics Research and Applications, 21*(3), 177-200. doi:10.1080/13675567.2017.1369501

Barker, S., & Mamiseishvili, K. (2014). Reconnecting: A phenomenological study

of transition within a shared model of academic advising. *Journal of Student Affairs Research and Practice, 51*(4), 433–445. doi:10.1515/jsarp-2014-0043

Barney, J. B. (1986). Strategic factor markets: Expectations, luck and business strategy. *Management Science, 32*(10), 1231-1241. doi:10.1287/mnsc.32.10.1231

Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management, 17*(1), 99. doi:10.1177/014920639101700108

Baroud, H., Ramirez-Marquez, J. E., Barker, K., & Rocco, C. M. (2014). Stochastic measures of network resilience: Applications to waterway commodity flows. *Risk Analysis, 34*(7), 1317–1335. doi:10.1111/risa.12175

Barrett, J. L., Mazerolle, S. M., & Eason, C. M. (2016). Exploring senior level athletic training students' perceptions on burnout and work-life balance. *Athletic Training Education Journal, 11*(2), 110-118. doi:10.4085/1102110

Bartlett, M., & Bartlett, J. (2016). Case study on the impact of technology on incivility in higher education. *The Journal of Educators Online, 13*(2). doi:10.9743/jeo.2016.2.7

Basu, A., Jain, T., & Hazra, J. (2018). Supplier selection under production learning and process improvements. *International Journal of Production Economics, 204*, 411–420. doi:10.1016/j.ijpe.2018.08.015

Baxter, P., & Jack, S. (2008). Qualitative case study methodology: Study design and implementation for novice researchers. *The Qualitative Report, 13*(4),

544-559. Retrieved from http://nsuworks.nova.edu

Beck, R., Pahlke, I., & Vykoukal, J. (2016). Colocation as a Hybrid ICT Sourcing Strategy to Improve Operational Agility. *The Database for Advances in Information Systems, 47*(2), 9–35. doi:10.1145/2963175.2963177

Behrens, R., McCormick, D., Orero, R., & Ommeh, M. (2017). Improving paratransit service: Lessons from inter-city matatu cooperatives in Kenya. *Transport Policy, 53*, 79–88. doi:10.1016/j.tranpol.2016.09.003

Benitez, J., Ray, G., & Henseler, J. (2018). Impact of information technology infrastructure flexibility on mergers and acquisitions. *MIS Quarterly, 42*(1), 2543. doi:10.25300/misq/2018/13245

Bennett, E. E., & McWhorter, R. R. (2016). Opening the black box and searching for smoking guns. *European Journal of Training and Development, 40*(8/9), 691–718. doi:10.1108/ejtd-07-2015-0049

Benoot, C., Hannes, K., & Bilsen, J. (2016). The use of purposeful sampling in a qualitative evidence synthesis: A worked example on sexual adjustment to a cancer trajectory. *BMC Medical Research Methodology, 16*(1). doi:10.1186/s12874-016-0114-6

Berman, E. (2017). An exploratory sequential mixed methods approach to understanding researchers' data management practices at UVM: Integrated findings to develop research data services. *Journal of eScience Librarianship, 6*(1), e1104. doi:10.7191/jeslib.2017.1104

Bettez, S. C. (2014). Navigating the complexity of qualitative research in

postmodern contexts: assemblage, critical reflexiviy, and communion as guides. *International Journal of Qualitative Studies in Education, 28*(8), 932–954. doi:10.1080/09518398.2014.948096

Bickerstaff, K., Devine-Wright, P., & Butler, C. (2015). Living with low carbon technologies: An agenda for sharing and comparing qualitative energy research. *Energy Policy, 84*, 241–249. doi:10.1016/j.enpol.2015.04.015

Bignami, F., Mattsson, P., & Hoekman, J. (2019). The importance of geographical distance to different types of R&D collaboration in the pharmaceutical industry. *Industry and Innovation*, 1–25. doi:10.1080/13662716.2018.1561361

Bistouni, F., & Jahanshahi, M. (2014). Analyzing the reliability of shuffle-exchange networks using reliability block diagrams. *Reliability Engineering & System Safety, 132*, 97–106. doi:10.1016/j.ress.2014.07.012

Bistouni, F., & Jahanshahi, M. (2015). Reliability analysis of multilayer multistage interconnection networks. *Telecommunication Systems, 62*(3), 529–551. doi:10.1007/s11235-015-0093-7

Boddy, C. R. (2016). Sample size for qualitative research. Qualitative Market Research: *An International Journal, 19*(4), 426–432. doi:10.1108/qmr-06-2016-0053

Boddy, K., Cowan, K., Gibson, A., & Britten, N. (2017). Does funded research reflect the priorities of people living with type 1 diabetes? A secondary analysis of research questions. *BMJ Open, 7*(9), e016540.

doi:10.1136/bmjopen-2017-016540

Borba, E., & Tavares, E. (2017). Stochastic modeling for performance and availability evaluation of hybrid storage systems. *Journal of Systems and Software, 134*, 1–11. doi:10.1016/j.jss.2017.08.043

Brito, L. A. L., & Sauan, P. K. (2016). Management Practices as Capabilities Leading to Superior Performance. *BAR - Brazilian Administration Review, 13*(3). doi:10.1590/1807-7692bar2016160004

Broadband access by fixed-satellite service systems. (2015). Retrieved from https://www.itu.int

Broadband Wireless Access. (2019). European Telecommunications Standards Institute. Retrieved from https://www.etsi.org/

Bromiley, P., & Rau, D. (2014). Towards a practice-based view of strategy. *Strategic Management Journal, 35*(8), 1249-1256. doi:10.1002/smj.2238

Bromiley, P., & Rau, D. (2016). Missing the point of the practice-based view. *Strategic Organization, 14*(3), 260-269. doi:10.1177/1476127016645840

Buckley, J., Brown, M., Thomson, S., Olsen, W., & Carter, J. (2015). Embedding quantitative skills into the social science curriculum: Case studies from Manchester. *International Journal of Social Research Methodology: Theory & Practice, 18*(5), 495-510. doi:10.1080/13645579.2015.1062624

Bulinska-Stangrecka, H., & Bagienska, A. (2018). Investigating the Links of Interpersonal Trust in Telecommunications Companies. *Sustainability, 10*(7), 2555. doi:10.3390/su10072555

Caloghirou, Y., Giotopoulos, I., Korra, E., & Tsakanikas, A. (2017). How do employee training and knowledge stocks affect product innovation? *Economics of Innovation and New Technology, 27*(4), 343–360. doi:10.1080/10438599.2017.1362796

Callou, G., Ferreira, J., Maciel, P., Tutsch, D., & Souza, R. (2014). An integrated modeling approach to evaluate and optimize data center sustainability, dependability and cost. *Energies, 7*(1), 238–277. doi:10.3390/en7010238

Camisón, C., & Puig-Denia, A. (2016). Are quality management practices enough to improve process innovation? *International Journal of Production Research, 54*(10), 2875-2894. doi:10.1080/00207543.2015.1113326

Cao, G., Duan, Y., & Cadden, T. (2019). The link between information processing capability and competitive advantage mediated through decision-making effectiveness. *International Journal of Information Management, 44*, 121–131. doi:10.1016/j.ijinfomgt.2018.10.003

Cappellaro, G. (2017). Ethnography in public management research: A systematic review and future directions. *International Public Management Journal, 20*(1), 14–48. doi:10.1080/10967494.2016.1143423

Carolan, C. M., Forbat, L., & Smith, A. (2015). Developing the DESCARTE model. *Qualitative Health Research, 26*(5), 626–639. doi:10.1177/1049732315602488

Carrera, Á., Iglesias, C. A., García-Algarra, J., & Kolarík, D. (2014). A real-life application of multi-agent systems for fault diagnosis in the provision of an

Internet business service. *Journal of Network and Computer Applications, 37*, 146–154. doi.org/10.1016/j.jnca.2012.11.004

Carter, N., Bryant-Lukosius, D., DiCenso, A., Blythe, J., & Neville, A. J. (2014). The use of triangulation in qualitative research. *Oncology Nursing Forum, 41*(5), 545–547. doi:10.1188/14.onf.545-547

Castillo-Montoya, M. (2016). Preparing for interview research: The interview protocol refinement framework. The Qualitative Report, *21*(5), 811-830. Retrieved from http://nsuworks.nova.edu

CEPT (2016). European Conference of Postal & Telecommunications Administrations. Electronic communications committee. FM-22 monitoring and enforcement. Retrieved from www.cept.org

Cesana, B. M., & Antonelli, P. (2016). Sample size calculations in clinical research should also be based on ethical principles. *Trials, 17*(1). doi:10.1186/s13063-016-1277-5

Chacón Vargas, J. R., Moreno Mantilla, C. E., & de Sousa Jabbour, A. B. L. (2018). Enablers of sustainable supply chain management and its effect on competitive advantage in the Colombian context. Resources, *Conservation and Recycling, 139*, 237–250. doi:10.1016/j.resconrec.2018.08.018

Chan, Z. C. Y. (2017). A qualitative study on communication between nursing students and the family members of patients. *Nurse Education Today, 59*, 33–37. doi:10.1016/j.nedt.2017.08.017

Chang, S. E., McDaniels, T., Fox, J., Dhariwal, R., & Longstaff, H. (2014).

Toward disaster-resilient cities: Characterizing resilience of infrastructure systems with expert judgments. *Risk Analysis, 34*(3), 416. doi:10.1111/risa.12133

Chen, J., Jiao, H., & Zhao, X. (2016). A knowledge-based theory of the firm: managing innovation in biotechnology. *Chinese Management Studies, 10*(1), 41-58. doi:10.1108/CMS-11-2015-0273

Chen, J., Liang, L., & Yao, D. (2018). Pre-positioning of relief inventories: a multi-product newsvendor approach. *International Journal of Production Research, 56*(18), 6294–6313. doi:10.1080/00207543.2018.1470342

Chen, J., Zhang, Y., Zhao, P., & Zhou, S. (2017). Allocation strategies of standby redundancies in series/parallel system. *Communications in Statistics - Theory and Methods, 47*(3), 708–724. doi:10.1080/03610926.2017.1313984

Chen, Y. J., Li, C., & Lan, K. G. (2015). Sample size adjustment based on promising interim results and its application in confirmatory clinical trials. Clinical Trials: *Journal of the Society for Clinical Trials, 12*(6), 584–595. doi:10.1177/1740774515594378

Choi, J. P., & Joo, C. (2015). Challenges for efficient and seamless space-terrestrial heterogeneous networks. *IEEE Communications Magazine, 53*(5), 156-162. doi:10.1109/MCOM.2015.7105655

Chowdhury, M. M. H., & Quaddus, M. (2017). Supply chain resilience: Conceptualization and scale development using dynamic capability theory.

International Journal of Production Economics, 188, 185–204. doi:10.1016/j.ijpe.2017.03.020

Choy, K. L., Gunasekaran, A., Lam, H. Y., Chow, K. H., Tsim, Y. C., Ng, T. W., . . . Lu, X. A. (2014). Impact of information technology on the performance of logistics industry: The case of Hong Kong and pearl delta region. *The Journal of the Operational Research Society, 65*(6), 904-916. doi: 10.1057/jors.2013.121

Chun, D. (2016). Exploring connections: aspiration levels, culture and the resource based view. *Journal of Strategy and Management, 9*(2), 202–215. doi:10.1108/jsma-01-2015-0002

Cimellaro, G. P., Arcidiacono, V., & Reinhorn, A. M. (2018). Disaster Resilience Assessment of Building and Transportation System. *Journal of Earthquake Engineering*, 1–27. doi:10.1080/13632469.2018.1531090

Clark, L., Birkhead, A. S., Fernandez, C., & Egger, M. J. (2017). A transcription and translation protocol for sensitive cross-cultural team research. *Qualitative Health Research, 27*(12), 1751–1764. doi:10.1177/1049732317726761

Cleary, M., Horsfall, J., & Hayter, M. (2014). Data collection and sampling in qualitative research: does size matter? *Journal of Advanced Nursing, 70*(3), 473–475. doi.org/10.1111/jan.12163

Coates, D., Phelan, R., Heap, J., & Howe, D. (2017). “Being in a group with others who have mental illness makes all the difference”: The views and

experiences of parents who attended a mental health parenting program. *Children and Youth Services Review, 78*, 104–111. doi:10.1016/j.childyouth.2017.05.015

Coetzee, C., & Van Niekerk, D. (2018). Should all disaster risks be reduced? A perspective from the systems concept of the edge of chaos. *Environmental Hazards, 17*(5), 470–481. doi:10.1080/17477891.2018.1463912

Collins, A. B., Strike, C., Guta, A., Baltzer Turje, R., McDougall, P., Parashar, S., & McNeil, R. (2017). "We're giving you something so we get something in return": Perspectives on research participation and compensation among people living with HIV who use drugs. *International Journal of Drug Policy, 39*, 92–98. doi:10.1016/j.drugpo.2016.09.004

Connelly, L. M. (2016). Understanding research. Trustworthiness in qualitative research. *MEDSURG Nursing, 25*(6), 435-436. Retrieved from http://www.medsurgnursing.net

Cook, D. A., Kuper, A., Hatala, R., & Ginsburg, S. (2016). When assessment data are words. *Academic Medicine, 91*(10), 1359–1369. doi:10.1097/acm.0000000000001175

Cope, D. G. (2014). Methods and meanings: Credibility and trustworthiness of qualitative research. *Oncology Nursing Forum, 41*(1), 89-91. doi:10.1188/14.ONF.89-91

Corsi, C., Prencipe, A., Rodríguez-Gulías, M. J., Rodeiro-Pazos, D., & Fernández-López, S. (2018). Growth of KIBS and non-KIBS firms: evidences from

university spin-offs. *The Service Industries Journal, 39*(1), 43–64. doi:10.1080/02642069.2018.1436703

Crump, B., & Peter, R. (2014). A case for non-profit organisations to engage in the use of shared computing services. Electronic *Journal of Information Systems Evaluation, 17*(1), 15. Retrieved from: www.ejise.com/main.html

da Costa, R. B., Hall, S. M., & Spear, A. (2016). Whose Reality? A meta-analysis of qualitative research in international and comparative education. *The Qualitative Report, 21*(4), 661-676. Retrieved from http://nsuworks.nova.edu

Dâmaso, A., Rosa, N., & Maciel, P. (2014). Reliability of wireless sensor networks. *Sensors, 14*(9), 15760-15785. doi:10.3390/s140915760

Danese, P., Lion, A., & Vinelli, A. (2018). Drivers and enablers of supplier sustainability practices: a survey-based analysis. *International Journal of Production Research*, 1–23. doi:10.1080/00207543.2018.1519265

Das, S., Panda, K. G., Sen, D., & Arif, W. (2019). A Survey of national disaster communication systems and spectrum allocation - an Indian perspective. *IETE Technical Review*, 1–26. doi:10.1080/02564602.2019.1566030

David-West, O., Iheanachor, N., & Kelikume, I. (2018). A resource-based view of digital financial services (DFS): An exploratory study of Nigerian providers. *Journal of Business Research, 88*, 513–526. doi:10.1016/j.jbusres.2018.01.034

De Massis, A., & Kotlar, J. (2014). The case study method in family business

research: Guidelines for qualitative scholarship. *Journal of Family Business Strategy, 5*(1), 15–29. doi:10.1016/j.jfbs.2014.01.007

De-Miguel-Molina, B., Hervás-Oliver, J.-L., & Boix, R. (2019). Understanding innovation in creative industries: knowledge bases and innovation performance in art restoration organisations. *Innovation: Organization & Management*, 1–22. doi:10.1080/14479338.2018.1562300

Delery, J. E., & Roumpi, D. (2017). Strategic human resource management, human capital and competitive advantage: is the field going in circles? *Human Resource Management Journal, 27*(1), 1–21. doi:10.1111/1748-8583.12137

Dennis, B. (2017). Validity as research praxis: A study of self-reflection and engagement in qualitative inquiry. *Qualitative Inquiry, 24*(2), 109–118. doi:10.1177/1077800416686371

Derrick-Mills, T. M. (2015). Exploring the Dimensions of Nonprofit Competition through its Supplementary, Complementary, and Adversarial Relationships with Government. *Nonprofit Policy Forum, 6*(2). doi:10.1515/npf-2014-0022

Dikbiyik, F., Tornatore, M., & Mukherjee, B. (2015). Exploiting Excess Capacity, Part II: Differentiated Services Under Traffic Growth. *IEEE/ACM Transactions on Networking, 23*(5), 1599-1609. doi:10.1109/TNET.2014.2335252

Dikko, M. (2016). Establishing construct validity and reliability: Pilot testing of a qualitative interview for research in Takaful (Islamic Insurance). *The*

Qualitative Report, 21(3), 521-528. Retrieved from http://nsuworks.nova.edu

Ding, L., Wang, H., Kang, K., & Wang, K. (2014). A novel method for SIL verification based on system degradation using reliability block diagram. *Reliability Engineering & System Safety, 132*, 36–45. doi:10.1016/j.ress.2014.07.005

Ding, L., Wang, H., Jiang, J., & Xu, A. (2017). SIL verification for SRS with diverse redundancy based on system degradation using reliability block diagram. *Reliability Engineering & System Safety, 165*, 170–187. doi:10.1016/j.ress.2017.03.005

Distefano, S., Longo, F., & Scarpa, M. (2017). Marking dependency in non-Markovian stochastic Petri nets. *Performance Evaluation, 110*, 22–47. doi:10.1016/j.peva.2017.03.001

Drabble, L., Trocki, K. F., Salcedo, B., Walker, P. C., & Korcha, R. A. (2015). Conducting qualitative interviews by telephone: Lessons learned from a study of alcohol use among sexual minority and heterosexual women. *Qualitative Social Work: Research and Practice, 15*(1), 118–133. doi:10.1177/1473325015585613

Dresch, A., Pacheco Lacerda, D., & Cauchick Miguel, P. A. (2015). A distinctive analysis of case study, action research and design science research. *Review of Business Management*, 1116–1133. doi:10.7819/rbgn.v17i56.2069

El Meladi, Y., Glavee-Geo, R., & Buvik, A. (2018). Understanding how opportunism and resource capability affect performance in exporter–LSP outsourcing relationships. *Logistique & Management, 26*(4), 229–246. doi:10.1080/12507970.2018.1526655

El Shafeey, T., & Trott, P. (2014). Resource-based competition: three schools of thought and thirteen criticisms. *European Business Review, 26*(2), 122–148. doi:10.1108/ebr-07-2013-0096

Elmusharaf, K., Byrne, E., Manandhar, M., Hemmings, J., & O'Donovan, D. (2016). Participatory ethnographic evaluation and research: Reflections on the research approach used to understand the complexity of maternal health issues in South Sudan. *Qualitative Health Research, 27*(9), 1345–1358. doi:10.1177/1049732316673975

Emmanuel, A., & Clow, S. E. (2017). A questionnaire for assessing breastfeeding intentions and practices in Nigeria: validity, reliability and translation. *BMC Pregnancy and Childbirth, 17*(1). doi:10.1186/s12884-017-1366-9

Ennis, R. P., Jolivette, K., & Losinski, M. (2017). The effects of writing choice prompt on the written narratives of students with emotional and behavioral disorders: A case study of an abandoned single-case design. *Behavioral Disorders, 42*(4), 185-195. doi.org/10.1177/0198742917709471

Espino-Rodriguez, T. F., & Ramirez-Fierro, J. C. (2018). Managers' attitudes toward hotel outsourcing in a tourist destination. An approach from the

benefits and risks perspective. *Tourism management perspectives, 26*, 143–152. doi:10.1016/j.tmp.2017.10.003

Estrada, I., Faems, D., & de Faria, P. (2016). Coopetition and product innovation performance: The role of internal knowledge sharing mechanisms and formal knowledge protection mechanisms. *Industrial Marketing Management, 53*, 56–65. doi:10.1016/j.indmarman.2015.11.013

ETC (n.d.). Emergency Telecommunications Cluster. Retrieved from https://www.etcluster.org

Evers, S. A., Hiligsmann, M., & Adarkwah, C. C. (2015). Risk of bias in trial-based economic evaluations: Identification of sources and bias-reducing strategies. *Psychology & Health, 30*(1), 52-71. doi:10.1080/08870446.2014.953532

Fayard, A.-L., & Weeks, J. (2014). Affordances for practice. *Information and Organization, 24*(4), 236–249. doi:10.1016/j.infoandorg.2014.10.001

Feiring, E., & Walter, A. B. (2017). Antimicrobial stewardship: a qualitative study of the development of national guidelines for antibiotic use in hospitals. *BMC Health Services Research, 17*(1). doi:10.1186/s12913-017-2683-4

Ferdinand, J. (2015). Building organisational cyber resilience: A strategic knowledge-based view of cyber security management. *Journal Of Business Continuity & Emergency Planning, 9*(2), 185-195.

Ferreira, C., Canhoto Neves, L., Silva, A., & de Brito, J. (2018). Stochastic Petri net-based modelling of the durability of renderings. *Automation in Construction, 87*, 96–105. doi:10.1016/j.autcon.2017.12.007

Ferrús, R., Koumaras, H., Sallent, O., Agapiou, G., Rasheed, T., Kourtis, M., & … Ahmed, T. (2016). SDN/NFV-enabled satellite communications networks: Opportunities, scenarios and challenges. *Physical Communication, 18*, 95–112. doi:10.1016/j.phycom.2015.10.007

Fisher, M., Boland, R., & Lyytinen, K. (2016). Social networking as the production and consumption of a self. *Information and Organization, 26*(4), 131–145. doi:10.1016/j.infoandorg.2016.11.001

Fleury, M. T. L., Mauro, M. de, Oliveira, L., Mauerberg Junior, A., & Fleury, A. (2019). Management practices and competitiveness: A multisector study in the Brazilian industry. *BAR - Brazilian Administration Review, 15*(4). doi:10.1590/1807-7692bar2018180028

Florczak, K. L. (2017). Adding to the truth of the matter: The case for qualitative research. *Nursing Science Quarterly, 30*(4), 296–299. doi:10.1177/0894318417724466

Forsgren, N., Durcikova, A., & Mills, R. J. (2016). Examining system administrators' verification information to enhance IT training design. *Journal of Computer Information Systems, 56*(4), 288–294. doi:10.1080/08874417.2016.1163999

Friesen, P., Kearns, L., Redman, B., & Caplan, A. L. (2017). Rethinking the Belmont Report? *The American Journal of Bioethics, 17*(7), 15–21. doi:10.1080/15265161.2017.1329482

Fusch, P. I., & Ness, L. R. (2015). Are we there yet? Data saturation in qualitative research. *The Qualitative Report, 20*(9), 1408-1416. Retrieved from http://nsuworks.nova.edu

Gagliardi, A. R., Ducey, A., Lehoux, P., Turgeon, T., Kolbunik, J., Ross, S., … Urbach, D. R. (2017). Multiple constraints compromise decision-making about implantable medical devices for individual patients: qualitative interviews with physicians. *BMC Medical Informatics and Decision Making, 17*(1). doi:10.1186/s12911-017-0577-3

Galvin, R. (2015). How many interviews are enough? Do qualitative interviews in building energy consumption research produce reliable knowledge? *Journal of Building Engineering, 1*, 2–12. doi:10.1016/j.jobe.2014.12.001

Gebauer, H., Haldimann, M., & Jennings Saul, C. (2017). A typology for management innovations. *European Journal of Innovation Management, 20*(4), 514–533. doi:10.1108/ejim-06-2016-0059

Gentles, S. J., Charles, C., Ploeg, J., & McKibbon, K. A. (2015). Sampling in qualitative research: Insights from an overview of the methods literature. *The Qualitative Report, 20*(11), 1772-1789. Retrieved from http://nsuworks.nova.edu

Ghadge, A., Kidd, E., Bhattacharjee, A., & Tiwari, M. K. (2018). Sustainable

procurement performance of large enterprises across supply chain tiers and geographic regions. *International Journal of Production Research*, 1–15. doi:10.1080/00207543.2018.1482431

Ghozzi, H., Soregaroli, C., Boccaletti, S., & Sauvée, L. (2016). Impacts of non-GMO standards on poultry supply chain governance: Transaction cost approach vs resource-based view. *Supply Chain Management: An International Journal, 21*(6), 743–758. doi:10.1108/scm-03-2016-0089

Goldstein, S. E. (2017). Reflexivity in narrative research: Accessing meaning through the participant-researcher relationship. *Qualitative Psychology, 4*(2), 149-164. doi:10.1037/qup0000035

Goodrich, A. (2019). Spending their leisure time: adult amateur musicians in a community band. *Music Education Research*, 1–11. doi:10.1080/14613808.2018.1563057

Goodyear, V. A. (2016). Sustained professional development on cooperative learning: Impact on six teachers' practices and students' learning. *Research Quarterly for Exercise and Sport, 88*(1), 83–94. doi.org/10.1080/02701367.2016.1263381

Gouda, S. K., & Saranga, H. (2018). Sustainable supply chains for supply chain sustainability: impact of sustainability efforts on supply chain risk. *International Journal of Production Research, 56*(17), 5820–5835. doi:10.1080/00207543.2018.1456695

Grant, R. M. (1996). Toward a knowledge-based theory of the firm. *Strategic*

Management Journal, 17(S2), 109–122. doi:10.1002/smj.4250171110

Green, J. (2014). Somatic sensitivity and reflexivity as validity tools in qualitative research. *Research in Dance Education, 16*(1), 67–79. doi:10.1080/14647893.2014.971234

Groote, J. F., Kouters, T. W., & Osaiweran, A. (2015). Specification guidelines to avoid the state space explosion problem. *Software Testing: Verification & Reliability, 25*(1), 4-33. doi:10.1002/stvr.1536

Guangdong, W., Qingshan, K., Jian-gang, S., Hamid Reza, K., & Wei, Z. (2014). Information Sharing and Channel Construction of Supply Chain under Asymmetric Demand Information. Journal of Applied Mathematics, 1-8. doi:10.1155/2014/107589

Guest, G., Bunce, A., & Johnson, L. (2006). How Many Interviews Are Enough? *Field Methods, 18*(1), 59–82. doi:10.1177/1525822x05279903

Guise, J.-M., Hansen, M., Lambert, W., & O'Brien, K. (2017). The role of simulation in mixed-methods research: a framework & application to patient safety. *BMC Health Services Research, 17*(1). doi:10.1186/s12913-017-2255-7

Gupta, V., Dharmaraja, S., & Arunachalam, V. (2015). Stochastic modeling for delay analysis of a VoIP network. *Annals of Operations Research, 233*(1), 171-180. doi:10.1007/s10479-013-1472-7

Hadi, M. A., & José Closs, S. (2015). Ensuring rigour and trustworthiness of qualitative research in clinical pharmacy. *International Journal of Clinical*

Pharmacy, 38(3), 641-646. doi:10.1007/s11096-015-0237-6

Hall, E., Chai, W., & Albrecht, J. A. (2016). A qualitative phenomenological exploration of teachers' experience with nutrition education. *American Journal of Health Education, 47*(3), 136–148. https://doi.org/10.1080/19325037.2016.1157532

Hallett, R. E., & Barber, K. (2013). Ethnographic research in a cyber era. *Journal of Contemporary Ethnography, 43*(3), 306–330. doi:10.1177/0891241613497749

Hamanaka Gusberti, T. D., Viegas, C. V., & Soares Echeveste, M. E. (2013). Organizational capability deployment analysis for technology conversion into processes, products and services. *Journal of Technology Management & Innovation, 8*(4), 21–22. doi:10.4067/s0718-27242013000500011

Hamid, Z. A., Tariq, K. R., Majed, M. B., & Rahm, T. D. (2015). Spectrum investigation for sharing analysis between BWA system and FSS receiver. *Journal of theoretical and applied information technology. 81*(2), 166. Retrieved from www.jatit.org

Hancock, M. E., Amankwaa, L., Revell, M. A., & Mueller, D. (2016). Focus group data saturation: A new approach to data analysis. *The Qualitative Report, 21*(11), 2124-2130. Retrieved from http://nsuworks.nova.edu

Hansen, C., Mena, C., & Aktas, E. (2018). The role of political risk in service offshoring entry mode decisions. *International Journal of Production Research*, 1–17. doi:10.1080/00207543.2018.1518601

Harris III, C. C. (2014). Maintaining Space Superiority. *Air & Space Power Journal, 28*(1), 68-82. Retrieved from http://www.airuniversity.af.mil

Harrison, C. G., & Williams, P. R. (2016). A systems approach to natural disaster resilience. *Simulation Modelling Practice and Theory, 65*, 11–31. doi:10.1016/j.simpat.2016.02.008

Haydon, G., Browne, G., & van der Riet, P. (2018). Narrative inquiry as a research methodology exploring person centred care in nursing. *Collegian, 25*(1), 125–129. doi:10.1016/j.colegn.2017.03.001

Helmig, B., Hinz, V., & Ingerfurth, S. (2015). Valuing organizational values: Assessing the uniqueness of nonprofit values. *Voluntas: International Journal of Voluntary & Nonprofit Organizations, 26*(6), 2554-2580. doi:10.1007/s11266-014-9530-6

Henniger, H., Seyfarth, S., & Diedrich, E. (2016). Analysis and comparison of new downlink technologies for earth observation satellites. *Radioengineering, 25*(1), 1–11. doi:10.13164/re.2016.0001

Hennink, M. M., Kaiser, B. N., & Marconi, V. C. (2016). Code saturation versus meaning saturation. *Qualitative Health Research, 27*(4), 591–608. doi:10.1177/1049732316665344

Herron, M. C., & Quinn, K. M. (2014). A careful look at modern case selection methods. *Sociological Methods & Research, 45*(3), 458–492. doi:10.1177/0049124114547053

Helm, R., Krinner, S., & Schmalfuß, M. (2014). Conceptualization and integration of marketing intelligence: The case of an industrial manufacturer. *Journal of Business-to-Business Marketing, 21*(4), 237–255. doi:10.1080/1051712x.2014.979587

Heydari, H., Rahnavard, Z., & Ghaffari, F. (2017). Exploring the position of community-based nursing in Iran: A aualitative study. *International Journal of Community Based Nursing and Midwifery, 5*(4), 386–396.

Hoeber, O., Snelgrove, R., Hoeber, L., & Wood, L. (2017). A systematic methodology for preserving the whole in large-scale qualitative-temporal research. *Journal of Sport Management, 31*(4), 387–400. doi:10.1123/jsm.2016-0278

Hörisch, J., Johnson, M. P., & Schaltegger, S. (2014). Implementation of Sustainability Management and Company Size: A Knowledge-Based View. *Business Strategy and the Environment, 24*(8), 765–779. doi:10.1002/bse.1844International

Hoskisson, R. E., Gambeta, E., Green, C. D., & Li, T. X. (2018). Is My Firm-Specific Investment Protected? Overcoming the Stakeholder Investment Dilemma in the Resource-Based View. *Academy of Management Review, 43*(2), 284–306. doi:10.5465/amr.2015.0411

Howe-Walsh, L., Turnbull, S., & Budhwar, P. (2018). An investigation into on-sourcing of advertising creativity in an emerging economy: The case of the

United Arab Emirates. *Journal of Business Research*. doi:10.1016/j.jbusres.2018.07.050

Hsieh, P. J., Chen, C. C., & Liu, W. (2019). Integrating talent cultivation tools to enact a knowledge-oriented culture and achieve organizational talent cultivation strategies. *Knowledge Management Research & Practice, 17*(1), 108–124. doi:10.1080/14778238.2019.1571872

Humphries, B., Radice, M., & Lauzier, S. (2017). Comparing "insider" and "outsider" news coverage of the 2014 Ebola outbreak. *Canadian Journal of Public Health, 108*(4), 381. doi:10.17269/cjph.108.5904

Hung, S.-Y., Tsai, J. C.-A., Lee, W.-T., & Chau, P. Y. K. (2015). Knowledge management implementation, business process, and market relationship outcomes. *Information Technology & People, 28*(3), 500–528. doi:10.1108/itp-12-2013-0209

Ilyushin, L. S., & Azbel, A. A. (2017). The modern Russian teacher: Studying awareness with the use of the semi-structured interview. *Psychology in Russia: State of the Art, 10*(1), 49–66. doi:10.11621/pir.2017.0104

Interference effect of transmissions from earth stations on board vessels operating in fixed-satellite service networks on terrestrial co-frequency stations. (2015). Retrieved from https://www.itu.int

Iyer, S., & Singh, S. P. (2017). Comparison of Cost, Power Consumption, and Spectrum Utilization in Protected Fixed- and Flexi-Grid Optical Networks. *IETE Journal of Research, 64*(5), 611–619.

doi:10.1080/03772063.2017.1369371

Jago, S., & Radford, J. (2016). SLT beliefs about collaborative practice: Implications for education and learning. *Child Language Teaching and Therapy, 33*(2), 199–213. doi:10.1177/0265659016679867

Jahanshahi, M., & Bistouni, F. (2014). A new approach to improve reliability of the multistage interconnection networks. *Computers & Electrical Engineering, 40*(8), 348–374. doi:10.1016/j.compeleceng.2014.10.019

Jajja, M. S. S., Chatha, K. A., & Farooq, S. (2018). Impact of supply chain risk on agility performance: Mediating role of supply chain integration. *International Journal of Production Economics*, *205*, 118–138. doi:10.1016/j.ijpe.2018.08.032

Jarzabkowski, P., Kaplan, S., Seidl, D., & Whittington, R. (2015). On the risk of studying practices in isolation: Linking what, who, and how in strategy research. *Strategic Organization, 14*(3), 248–259. doi:10.1177/1476127015604125

Jensen, J. A., Cobbs, J. B., & Turner, B. A. (2016). Evaluating sponsorship through the lens of the resource-based view: The potential for sustained competitive advantage. *Business Horizons*, *59*(2), 163–173. doi:10.1016/j.bushor.2015.11.001

Jeon, H. J. (Jean), Dant, R. P., & Baker, B. L. (2016). A knowledge-based explanation of franchise system resources and performance. *Journal of Marketing Channels, 23*(3), 97–113. doi:10.1080/1046669x.2016.1186470

Jifeng, L., Ming, F., & Han, Z. (2016). Information technology, cross-channel capabilities, and managerial actions: Evidence from the apparel industry. *Journal of the Association For Information Systems, 17*(5), 308-327. Retrieved from www.aisel.aisnet.org/jais/

Johansson, V., Soekadar, S. R., & Clausen, J. (2017). Locked Out. *Cambridge Quarterly of Healthcare Ethics, 26*(4), 555. doi:10.1017/S0963180117000081

Johnson, M., O'Hara, R., Hirst, E., Weyman, A., Turner, J., Mason, S., … Siriwardena, A. N. (2017). Multiple triangulation and collaborative research using qualitative methods to explore decision making in pre-hospital emergency care. *BMC Medical Research Methodology, 17*(1). doi:10.1186/s12874-017-0290-z

Kacimi, R., & Pech, P. (2014). Hybrid Satellite - Wireless sensor networks architecture for telemedicine applications in the context of emergency satellite communications in Ku/Ka/Q/V bands. *ICST transactions on mobile communications and applications, 2*(5), e1. doi:10.4108/mca.2.5.e1

Kahraman, M., & Kuzu, A. (2016). E-mentoring for professional development of pre-service teachers: A case study. *Turkish Online Journal of Distance Education, 17*(3), 76-89. doi:10.17718/tojde.19973

Kallio, H., Pietilä, A.-M., Johnson, M., & Kangasniemi, M. (2016). Systematic methodological review: developing a framework for a qualitative semi-structured interview guide. *Journal of Advanced Nursing, 72*(12), 2954–

2965. doi:10.1111/jan.13031

Kamboj, S., Goyal, P., & Rahman, Z. (2015). A resource-based view on marketing capability, operations capability and financial performance: An empirical examination of mediating role. *Procedia - Social and Behavioral Sciences, 189*, 406–415. doi:10.1016/j.sbspro.2015.03.201

Kapovits, A., Corici, M.-I., Gheorghe-Pop, I.-D., Gavras, A., Burkhardt, F., Schlichter, T., & Covaci, S. (2018). Satellite communications integration with terrestrial networks. *China Communications, 15*(8), 22–38. doi:10.1109/cc.2018.8438271

Karia, N. (2018). Knowledge resources, technology resources and competitive advantage of logistics service providers. *Knowledge Management Research & Practice, 16*(3), 414–426. doi:10.1080/14778238.2018.1496570

Kasturirangan, K., & Joglekar, M. D. (2015). Social dimensions of India's space programme. *Current Science, 108*(3), 310-312. Retrieved from www.currentscience.ac.in

Kemp, C. L., Ball, M. M., Morgan, J. C., Doyle, P. J., Burgess, E. O., Dillard, J. A., … Perkins, M. M. (2016). Exposing the backstage: Critical reflections on a longitudinal qualitative study of residents' care networks in assisted living. *Qualitative Health Research, 27*(8), 1190–1202. doi:10.1177/1049732316668817

Kennedy, C., & Miceli, T. (2016). Cultivating effective corpus use by language learners. *Computer Assisted Language Learning, 30*(1-2), 91–114.

doi:10.1080/09588221.2016.1264427

Keutel, M., Michalik, B., & Richter, J. (2014). Towards mindful case study research in IS: A critical analysis of the past ten years. *European Journal of Information Systems, 23*(3), 256-272. doi:http://dx.doi.org/10.1057/ejis.2013.26

Kim, H., Hoskisson, R. E., & Lee, S. (2015). Why strategic factor markets matter: 'New' multinationals' geographic diversification and firm profitability. *Strategic Management Journal, 36*(4), 518-536. doi:10.1002/smj.2229

Kim, S., Kim, Y. E., Bae, K. J., Choi, S. B., Park, J. K., Koo, Y. D., … & Hong, S. W. (2013). NEST: A quantitative model for detecting emerging trends using a global monitoring expert network and Bayesian Network. *Futures, 52*, 59–73. doi:10.1016/j.futures.2013.08.004

Kleyner, A., & Volovoi, V. (2010). Application of Petri nets to reliability prediction of occupant safety systems with partial detection and repair. *Reliability Engineering & System Safety, 95*(6), 606–613. doi:10.1016/j.ress.2010.01.008

Ko, F. (2016). Comparisons of allocating sample size rationally into individual regions under heterogeneous effect size in a multiregional trial by a fixed effect model and a random effect model. *Communications in Statistics - Theory and Methods, 45*(23), 7060–7074. doi:10.1080/03610926.2014.974823

König, C., Caldwell, N. D., & Ghadge, A. (2018). Service provider boundaries in

competitive markets: the case of the logistics industry. *International Journal of Production Research*, 1–16. doi:10.1080/00207543.2018.1535203

Koonrungsesomboon, N., & Karbwang, J. (2016). Ethical considerations in clinical research on herbal medicine for prevention of cardiovascular disease in the ageing. *Phytomedicine, 23*(11), 1090–1094. https://doi.org/10.1016/j.phymed.2015.10.017

Kor, Y. Y., & Mahoney, J. T. (2004). Edith Penrose's (1959) Contributions to the resource-based view of strategic management. *Journal of Management Studies, 41*(1), 183. doi:10.1111/j.1467-6486.2004.00427.x

Koran, J. (2016). Preliminary proactive sample size determination for confirmatory factor analysis models. *Measurement and Evaluation in Counseling and Development, 49*(4), 296–308. doi:10.1177/0748175616664012

Koriem, A. S., Tarrad, I. F., & Farahat, H. (2014). Petri net reliability models for CORBA wireless networks. *Wireless Personal Communications, 82*(1), 293–325. doi:10.1007/s11277-014-2209-x

Korstjens, I., & Moser, A. (2017). Series: Practical guidance to qualitative research. Part 4: Trustworthiness and publishing. *The European Journal of General Practice*, 1-5. doi:10.1080/13814788.2017.1375092

Kourogiorgas, C. I., Sakarellos, V. K., Kanellopoulos, S. A., & Panagopoulos, A. D. (2014). Enhancing resiliency of broadband satellite communication emergency networks through propagation impairment mitigation

techniques. *Journal of Current Issues in Media & Telecommunications, 6*(2), 159-191.

Kozleski, E. B. (2017). The uses of qualitative research. *Research & Practice for Persons with Severe Disabilities, 42*(1), 19-32. doi:10.1177/1540796916683710

Kraft, S. A., Porter, K. M., Shah, S. K., & Wilfond, B. S. (2017). Comprehension and choice under the revised common rule: Improving informed consent by offering reasons why some enroll in research and others do not. *The American Journal of Bioethics, 17*(7), 53–55. doi:10.1080/15265161.2017.1328535

Kull, A. J., Mena, J. A., & Korschun, D. (2016). A resource-based view of stakeholder marketing. *Journal of Business Research, 69*(12), 5553–5560. doi:10.1016/j.jbusres.2016.03.063

Kumar, R., Kudinov, P., Bechta, S., Curnier, F., & Marques, M. (2015). Dynamic hybrid reliability studies of a decay heat removal system. *International Journal of Reliability, Quality & Safety Engineering, 22*(4), -1. doi:10.1142/S0218539315500205

Lambakis, S. (2018). Foreign space capabilities: Implications for U.S. national security. *Comparative Strategy, 37*(2), 87–154. doi:10.1080/01495933.2018.1459144

Lantos, J. D. (2017). Informed consent for comparative effectiveness research should not consider the risks of the standard therapies that are being studied

as risks of the research. *Journal of Law, Medicine & Ethics, 45*(3), 365-374. doi:10.1177/1073110517737537

Le Roux, C. S. (2016). Exploring rigour in autoethnographic research. International *Journal of Social Research Methodology, 20*(2), 195–207. doi:10.1080/13645579.2016.1140965

Lei, L., Wang, H., Lin, C., & Zhong, Z. (2014). Wireless channel model using stochastic high-level Petri nets for cross-layer performance analysis in orthogonal frequency-division multiplexing system. *IET Communications, 8*(16), 2871–2880. doi:10.1049/iet-com.2014.0394

Leppink, J. (2017). Revisiting the quantitative–qualitative-mixed methods labels: Research questions, developments, and the need for replication. *Journal of Taibah University Medical Sciences, 12*(2), 97–101. doi:10.1016/j.jtumed.2016.11.008

Leung, L. (2015). Validity, reliability, and generalizability in qualitative research. *Journal of Family Medicine and Primary Care, 4*(3), 324. doi:10.4103/2249-4863.161306

Li, C., Zhu, L., & Luo, Z. (2017). Underdetermined blind source separation of adjacent satellite interference based on sparseness. *China Communications, 14*(4), 140–149. doi:10.1109/cc.2017.7927572

Li, L., Zeng, W., Hong, Z., & Zhou, L. (2016). Stochastic Petri Net-based performance evaluation of hybrid traffic for social networks system. *Neurocomputing, 204,* 3–7. doi:10.1016/j.neucom.2015.09.131

Li, P. (2018). A tale of two clusters: knowledge and emergence. *Entrepreneurship & Regional Development, 30*(7-8), 822–847. doi:10.1080/08985626.2018.1462857

Li, Z., Yu, F. R., & Bin, N. (2015). Service availability analysis in communication-based train control systems using wireless local area networks. *Wireless Communications & Mobile Computing, 15*(1), 16-29. doi:10.1002/wcm.2313

Liao, S.-H., Hu, D.-C., & Ding, L.-W. (2017). Assessing the influence of supply chain collaboration value innovation, supply chain capability and competitive advantage in Taiwan's networking communication industry. *International Journal of Production Economics, 191*, 143–153. https://doi.org/10.1016/j.ijpe.2017.06.001

Liabo, K. (2016). Care leavers' involvement in research: An ethnographic case study on impact. *Qualitative Social Work: Research and Practice, 17*(1), 133–151. doi:10.1177/1473325016649255

Lijadi, A. A., & van Schalkwyk, G. J. (2015). Online Facebook focus group research of hard-to-reach participants. *International Journal of Qualitative Methods, 14*(5), 1-9. doi:10.1177/1609406915621383

Lichtenthaler, U. (2016). Alliance portfolio capability. *Journal of Strategy and Management, 9*(3), 281–301. doi:10.1108/jsma-05-2015-0035

Lim, S., Wang, T. K., & Lee, S.-Y. (2017). Shedding new light on strategic human resource management: The impact of human resource management

practices and human resources on the perception of federal agency mission accomplishment. *Public Personnel Management, 46*(2), 91–117. doi:10.1177/0091026017704440

Lira, V., Tavares, E., Fernandes, S., & Maciel, P. (2015). Dependable virtual network mapping. *Computing, 97*(5), 459-481. doi:10.1007/s00607-014-0431-8

Lorentz, H., Kumar, M., & Srai, J. S. (2018). Managing distance in international purchasing and supply: a systematic review of literature from the resource-based view perspective. *International Business Review, 27*(2), 339–354. doi:10.1016/j.ibusrev.2017.09.002

Lourenço, R. B. R., Figueiredo, G. B., Tornatore, M., & Mukherjee, B. (2019). Data evacuation from data centers in disaster-affected regions through software-defined satellite networks. *Computer Networks, 148*, 88–100. doi:10.1016/j.comnet.2018.10.019

Low, K. Y. J., & Ho, E. Y.-C. (2016). A Knowledge-based theory of the multinational economic organization. *Long Range Planning, 49*(6), 641–647. doi:10.1016/j.lrp.2015.12.004

Lu, Y., Zhao, Y., Sun, F., & Li, H. (2014). A survivable routing protocol for two-layered LEO/MEO satellite networks. *Wireless Networks, 20*(5), 871-887. doi:10.1007/s11276-013-0656-z

Lutz, E. (2015). Co-channel interference in high-throughput multibeam satellite systems. *2015 IEEE International Conference on Communications (ICC), 885*. doi:10.1109/ICC.2015.7248434

Ma, T., Lee, Y., & Ma, M. (2013). Protecting satellite systems from disassociation DoS attacks. *Wireless Personal Communications, 69*(2), 623-638. doi:10.1007/s11277-012-0593-7

Mabila, T. E. (2017). Postgraduate students' understanding of mixed methods research design at the proposal stage. *South African Journal of Higher Education, 31*(5), 136–153. doi.org/10.28535/31-5-1498

Magudu, S., & Gumbo, M. (2017). Encounters of newly qualified teachers with micro-politics in primary schools in Zimbabwe. *South African Journal of Education, 37*(2), 1–11. doi:10.15700/saje.v37n2a1264

Mahdi, O. R., Nassar, I. A., & Almsafir, M. K. (2019). Knowledge management processes and sustainable competitive advantage: An empirical examination in private universities. *Journal of Business Research, 94*, 320–334. doi:10.1016/j.jbusres.2018.02.013

Maher, A. J. (2014). Special educational needs in mainstream secondary school physical education: learning support assistants have their say. *Sport, Education and Society, 21*(2), 262–278. doi:10.1080/13573322.2014.905464

Mak, P. W., & Singleton, J. (2017). Burning questions: Exploring the impact of natural disasters on community pharmacies. *Research in Social and*

Administrative Pharmacy, 13(1), 162–171. doi:10.1016/j.sapharm.2015.12.015

Malik, M. S., & Kanwal, M. (2018). Impacts of organizational knowledge sharing practices on employees' job satisfaction. *Journal of Workplace Learning, 30*(1), 2–17. doi:10.1108/jwl-05-2016-0044

Malterud, K. (2015). Theory and interpretation in qualitative studies from general practice: Why and how? *Scandinavian Journal of Public Health, 44*(2), 120–129. doi:10.1177/1403494815621181

Mao, H., Liu, S., & Zhang, J. (2015). How the effects of IT and knowledge capability on organizational agility are contingent on environmental uncertainty and information intensity. *Information Development, 31*(4), 358-382. doi:10.1177/0266666913518059

Mason, D. M., & Ide, B. (2014). Adapting qualitative research strategies to technology savvy adolescents. *Nurse Researcher, 21*(5), 40. doi:10.7748/nr.21.5.40.e1241

Mathooko, F. M., & Ogutu, M. (2015). Porter's five competitive forces framework and other factors that influence the choice of response strategies adopted by public universities in Kenya. *International Journal of Educational Management, 29*(3), 334–354. doi:10.1108/ijem-12-2013-0187

Matos, R., Araujo, J., Oliveira, D., Maciel, P., & Trivedi, K. (2015). Sensitivity analysis of a hierarchical model of mobile cloud computing. *Simulation Modelling Practice and Theory, 50*, 151–164.

doi:10.1016/j.simpat.2014.04.003

Matoso, J. O., & Abib, G. (2016). Competitive advantage of a franchisee in the software market: the case of Totvs. *Journal of Information Systems and Technology Management, 12*(3), 627-646. doi:10.4301/s1807-17752015000300007

McAdam, R., Humphreys, P., Galbraith, B., & Miller, K. (2017). Developing management capability within a horizontal supply chain in performance measurement deployment and evolution: A dynamic capabilities and goal theory perspective. *Production Planning & Control, 28*(6-8), 610–628. doi:10.1080/09537287.2017.1309706

McAloon, C. G., Macken-Walsh, Á., Moran, L., Whyte, P., More, S. J., O'Grady, L., & Doherty, M. L. (2017). Johne's disease in the eyes of Irish cattle farmers: A qualitative narrative research approach to understanding implications for disease management. *Preventive Veterinary Medicine, 141*, 7–13. doi:10.1016/j.prevetmed.2017.04.001

McCarrier, K. P., Atkinson, T. M., DeBusk, K. P. A., Liepa, A. M., Scanlon, M., & Coons, S. J. (2016). Qualitative development and content validity of the non–small cell lung cancer symptom assessment questionnaire (NSCLC-SAQ), a patient-reported outcome instrument. *Clinical Therapeutics, 38*(4), 794–810. doi:10.1016/j.clinthera.2016.03.012

McCormick, T. H., Lee, H., Cesare, N., Shojaie, A., & Spiro, E. S. (2015). Using twitter for demographic and social science research: Tools for data

collection and processing. *Sociological Methods & Research, 46*(3), 390–421. doi:10.1177/0049124115605339

McCusker, K., & Gunaydin, S. (2015). Research using qualitative, quantitative or mixed methods and choice based on the research. *Perfusion, 30*(7), 537-542. doi:10.1177/0267659114559116

McKim, C. A. (2016). The value of mixed methods research. *Journal of Mixed Methods Research, 11*(2), 202–222. doi:10.1177/1558689815607096

Methodology to estimate the sensitivity of GSO FSS interference levels to the geographical location of earth stations communicating with GSO satellites in the fixed-satellite service in the 14 GHz and 30 GHz frequency ranges. (2015). Retrieved from https://www.itu.int

Middleton, A., Gunn, J., Bassilios, B., & Pirkis, J. (2016). The experiences of frequent users of crisis helplines: A qualitative interview study. *Patient Education and Counseling, 99*(11), 1901–1906. doi:10.1016/j.pec.2016.06.030

Miller, D. (2017). Disruptive texts: Case narratives as research inspirations. *Academy of Management Review, 42*(1), 154-164. doi:10.5465/amr.2015.0418

Miranda, K., Molinaro, A., & Razafindralambo, T. (2016). A survey on rapidly deployable solutions for post-disaster networks. *IEEE Communications Magazine, 54*(4), 117-123. doi:10.1109/MCOM.2016.7452275

Mitra, A., O'Regan, N., & Sarpong, D. (2018). Cloud resource adaptation: A

resource based perspective on value creation for corporate growth. *Technological Forecasting and Social Change, 130,* 28–38. doi:10.1016/j.techfore.2017.08.012

Moezzi, M., Janda, K. B., & Rotmann, S. (2017). Using stories, narratives, and storytelling in energy and climate change research. *Energy Research & Social Science, 31*, 1–10. doi:10.1016/j.erss.2017.06.034

Mohiuddin, M., Rashid, M. M., Al Azad, M. S., & Su, Z. (2018). Back-shoring or re-shoring: determinants of manufacturing offshoring from emerging to least developing countries (LDCs). *International Journal of Logistics Research and Applications, 22*(1), 78–97. doi:10.1080/13675567.2018.1475554

Molina-Azorín, J. F. (2014). Microfoundations of strategic management: Toward micro–macro research in the resource-based theory. *BRQ Business Research Quarterly, 17*(2), 102–114. doi:10.1016/j.brq.2014.01.001

Molloy, J. C., & Barney, J. B. (2015). Who captures the value created with human capital? A market-based view. *Academy of Management Perspectives, 29*(3), 309–325. doi:10.5465/amp.2014.0152

Moon, K., Brewer, T. D., Januchowski-Hartley, S. R., Adams, V. M., & Blackman, D. A. (2016). A guideline to improve qualitative social science publishing in ecology and conservation journals. *Ecology and Society, 21*(3). doi:10.5751/es-08663-210317

Moradi, H., & Shadrokh, S. (2018). A robust scheduling for the multi-mode project

scheduling problem with a given deadline under uncertainty of activity duration. *International Journal of Production Research*, 1–30. doi:10.1080/00207543.2018.1552371

Morse, J. M. (2016). Underlying ethnography. *Qualitative Health Research, 26*(7), 875–876. doi:10.1177/1049732316645320

Montero, J. M., Ocampo, A. M., & Fonseca, N. J. G. (2015). C-band multiple beam antennas for communication satellites. *IEEE transactions on antennas and propagation, 63*(4), 1263–1275. doi:10.1109/tap.2015.2395444

Morgan, S. J., Pullon, S. R. H., Macdonald, L. M., McKinlay, E. M., & Gray, B. V. (2016). Case study observational research: A framework for conducting case study research where observation data are the focus. *Qualitative Health Research, 27*(7), 1060–1068. doi:10.1177/1049732316649160

Morse, J. M., & Cheek, J. (2014). Making room for qualitatively-driven mixed-method research. *Qualitative Health Research, 24*(1), 3-5. doi:10.1177/1049732313513656

Munn, Z., Porritt, K., Lockwood, C., Aromataris, E., & Pearson, A. (2014). Establishing confidence in the output of qualitative research synthesis: the ConQual approach. *BMC Medical Research Methodology, 14*(1). doi:10.1186/1471-2288-14-108

Munroe, B., Curtis, K., Buckley, T., Lewis, M., & Atkins, L. (2017). Optimising implementation of a patient-assessment framework for emergency nurses: A mixed-method study. *Journal of Clinical Nursing, 27*(1-2), e269–e286.

doi:10.1111/jocn.13932

Munafò, M. R., Nosek, B. A., Bishop, D. V. M., Button, K. S., Chambers, C. D., Percie du Sert, N., … Ioannidis, J. P. A. (2017). A manifesto for reproducible science. *Nature Human Behaviour, 1*(1), 0021. doi:10.1038/s41562-016-0021

Muthathi, I. S., Thurling, C. H., & Armstrong, S. J. (2017). Through the eyes of the student: Best practices in clinical facilitation. *Curationis, 40*(1). doi:10.4102/curationis.v40i1.1787

Nadeem Ahmad, Q., & Usman, G. (2015). Knowledge management: The way to organizational competitive advantage. *Oeconomics of Knowledge, 7*(1), 25-35. Retrieved from https://sites.google.com/site/oeconomicsofknowledge/home

Nag, S., Li, A. S., & Merrick, J. H. (2018). Scheduling algorithms for rapid imaging using agile Cubesat constellations. *Advances in Space Research, 61*(3), 891–913. doi:10.1016/j.asr.2017.11.010

Namey, E., Guest, G., McKenna, K., & Chen, M. (2016). Evaluating bang for the buck. *American Journal of Evaluation, 37*(3), 425–440. doi:10.1177/1098214016630406

Nandi, A., & Platt, L. (2016). Are there differences in responses to social identity questions in face-to-face versus telephone interviews? Results of an experiment on a longitudinal survey. I*nternational Journal of Social Research Methodology, 20*(2), 151–166.

doi:10.1080/13645579.2016.1165495

Nelson, J. (2016). Using conceptual depth criteria: addressing the challenge of reaching saturation in qualitative research. *Qualitative Research, 17*(5), 554–570. doi:10.1177/1468794116679873

Neuman, D. (2014). Qualitative research in educational communications and technology: A brief introduction to principles and procedures. *Journal of Computing in Higher Education, 26*(1), 69-86. doi:10.1007/s12528-014-9078-x

Nolte, I. M. (2018). Interorganizational collaborations for humanitarian aid: An analysis of partnership, community, and single organization outcomes. *Public Performance & Management Review, 41*(3), 596–619. doi:10.1080/15309576.2018.1462212

Nordsteien, A., Horntvedt, M.-E. T., & Syse, J. (2017). Use of research in undergraduate nursing students' theses: A mixed methods study. *Nurse Education Today, 56*, 23–28. https://doi.org/10.1016/j.nedt.2017.06.001

O'Cathain, A., Goode, J., Drabble, S. J., Thomas, K. J., Rudolph, A., & Hewison, J. (2014a). Getting added value from using qualitative research with randomized controlled trials: a qualitative interview study. *Trials, 15*(1), 215. doi:10.1186/1745-6215-15-215

O'Cathain, A., Thomas, K. J., Drabble, S. J., Rudolph, A., Goode, J., & Hewison, J. (2014b). Maximising the value of combining qualitative research and randomised controlled trials in health research: the QUAlitative Research in

Trials (QUART) study – a mixed methods study. *Health Technology Assessment, 18*(38). doi:10.3310/hta18380

O'Dwyer, M., & Gilmore, A. (2018). Value and alliance capability and the formation of strategic alliances in SMEs: The impact of customer orientation and resource optimisation. *Journal of Business Research, 87*, 58–68. doi:10.1016/j.jbusres.2018.02.020

O'Reilly, N. M., & Robbins, P. (2018). Dynamic capabilities and the entrepreneurial university: a perspective on the knowledge transfer capabilities of universities. *Journal of Small Business & Entrepreneurship*, 1–21. doi:10.1080/08276331.2018.1490510

Office for human research protections. (1979). The Belmont report. U.S. Department of Health & Human Services. Retrieved from www.hhs.gov

Ojha, D., Struckell, E., Acharya, C., & Patel, P. C. (2018). Supply chain organizational learning, exploration, exploitation, and firm performance: A creation-dispersion perspective. *International Journal of Production Economics, 204*, 70–82. doi:10.1016/j.ijpe.2018.07.025

Okaro, I. A., & Tao, L. (2016). Reliability analysis and optimisation of subsea compression system facing operational covariate stresses. *Reliability Engineering & System Safety, 156*, 159–174. doi:10.1016/j.ress.2016.07.018

Oliver, J. J. (2018). Strategic transformations in the media. *Journal of Media Business Studies, 15*(4), 278–299. doi:10.1080/16522354.2018.1546088

Olszak, C. M., Bartuś, T., & Lorek, P. (2018). A comprehensive framework of information system design to provide organizational creativity support. *Information & Management, 55*(1), 94–108. doi:10.1016/j.im.2017.04.004

Özçelik, G., Aybas, M., & Uyargil, C. (2016). High performance work systems and organizational values: Resource-based view considerations. *Procedia - Social and Behavioral Sciences, 235*, 332–341. doi:10.1016/j.sbspro.2016.11.040

Palinkas, L. A., Horwitz, S. M., Green, C. A., Wisdom, J. P., Duan, N., & Hoagwood, K. (2013). Purposeful sampling for qualitative data collection and analysis in mixed method implementation research. *Administration and Policy in Mental Health and Mental Health Services Research, 42*(5), 533–544. doi:10.1007/s10488-013-0528-y

Pan, G., Pan, S.-L., & Lim, C.-Y. (2015). Examining how firms leverage IT to achieve firm productivity: RBV and dynamic capabilities perspectives. *Information & Management, 52*(4), 401–412. doi:10.1016/j.im.2015.01.001

Panagopoulos, A. D., Kritikos, T. D., Livieratos, S. N., & Kanellopoulos, J. D. (2014). Interference studies between adjacent satellite communications systems operating above 10 GHz and using power control as fade mitigation technique. *Wireless Personal Communications, 77*(2), 1311–1327. doi:10.1007/s11277-013-1582-1

Pandey, S., & Chawla, D. (2016). Using qualitative research for establishing content validity of e-lifestyle and website quality constructs. *Qualitative*

Market Research: An International Journal, 19(3), 339–356. doi:10.1108/qmr-05-2015-0033

Parida, V., & Örtqvist, D. (2015). Interactive effects of network capability, ICT capability, and financial slack on technology-based small firm innovation performance. *Journal of Small Business Management, 53*, 278–298. doi:10.1111/jsbm.12191

Park, J., Lee, J.-N., Lee, O.-K. D., & Koo, Y. (2017). Alignment between internal and external IT governance and its effects on distinctive firm performance: An extended resource-based View. *IEEE Transactions on Engineering Management, 64*(3), 351–364. doi:10.1109/tem.2017.2678485

Park, S. (2018). Cutbacks revisited: the relationship between resources and performance. *Public Management Review, 21*(4), 515–536. doi:10.1080/14719037.2018.1500631

Patton, M. Q. (1999). Enhancing the quality and credibility of qualitative analysis. *Health Services Research, 34*(5 Pt 2), 1189-1208.

Paul, K. B. (2017). Introducing interpretive approach of phenomenological research methodology in environmental philosophy. *International Journal of Qualitative Methods, 16*(1), 160940691772491. doi:10.1177/1609406917724916

Pawluk, S. A., & Zolezzi, M. (2017). Healthcare professionals' perspectives on a mental health educational campaign for the public. *Health Education Journal, 76*(4), 479–491. doi:10.1177/0017896917696121

Pee, L. G., & Kankanhalli, A. (2016). Interactions among factors influencing knowledge management in public-sector organizations: A resource-based view. *Government Information Quarterly, 33*(1), 188–199. doi:10.1016/j.giq.2015.06.002

Peck, B., & Mummery, J. (2017). Hermeneutic constructivism: An ontology for qualitative research. *Qualitative Health Research, 28*(3), 389–407. doi:10.1177/1049732317706931

Pecorella, T., Ronga, L. S., Chiti, F., Jayousi, S., & Franck, L. (2015). Emergency satellite communications: Research and standardization activities. *IEEE Communications Magazine, 53*(5), 170-177. doi:10.1109/MCOM.2015.7105657

Pelletier, J. E., Caspi, C. E., Schreiber, L. R. N., Erickson, D. J., Harnack, L., & Laska, M. N. (2016). Successful customer intercept interview recruitment outside small and midsize urban food retailers. *BMC Public Health, 16*(1). doi:10.1186/s12889-016-3717-2

Penrose, E. (1955). Research on the business firm limits to the growth and size of firms. *American Economic Review, 45*(2), 531. Retrieved from https://www.aeaweb.org/journals/aer

Pérez-Luño, A., Alegre, J., & Valle-Cabrera, R. (2018). The role of tacit knowledge in connecting knowledge exchange and combination with innovation. *Technology Analysis & Strategic Management, 31*(2), 186–198. doi:10.1080/09537325.2018.1492712

Perridge, D., Hefferon, K., Lomas, T., & Ivtzan, I. (2017). “I feel I can live every minute if I choose to”: participants’ experience of a positive mindfulness programme. *Qualitative Research in Psychology, 14*(4), 482–504. doi:10.1080/14780887.2017.1359709

Petherick, A. (2015). Ebola in west Africa: learning the lessons. *The Lancet, 385*(9968), 591–592. doi:10.1016/s0140-6736(15)60075-7

Petty, N. J., Thomson, O. P., & Stew, G. (2012). Ready for a paradigm shift? Part 2: Introducing qualitative research methodologies and methods. *Manual Therapy, 17*(5), 378–384. doi:10.1016/j.math.2012.03.004

Plano Clark, V. L. (2016). Mixed methods research. *The Journal of Positive Psychology, 12*(3), 305–306. doi:10.1080/17439760.2016.1262619

Polacsek, M., Boardman, G., & McCann, T. V. (2016). Paying patient and caregiver research participants: putting theory into practice. *Journal of Advanced Nursing, 73*(4), 847–856. doi:10.1111/jan.13222

Pompeii, B. (2015). The use of public radio as a tool in qualitative geographic research. *GeoJournal, 80*(6), 791–802. doi:10.1007/s10708-015-9647-1

Porter, M. E. (1980). Industry Structure and Competitive Strategy: Keys to Profitability. *Financial Analysts Journal, 36*(4), 30–41. doi:10.2469/faj.v36.n4.30

Porteri, C., Togni, E., & Pasqualetti, P. (2013). The policies of ethics committees in the management of biobanks used for research: an Italian survey. *European Journal of Human Genetics, 22*(2), 260–265.

doi:10.1038/ejhg.2013.107

Question 5/1: Telecommunications/ICTs for rural and remote areas. (2017). Retrieved from https://www.itu.int

Question 5/2: Utilization of telecommunications/ICTs for disaster preparedness, mitigation and response. (2017). Retrieved from https://www.itu.int

Racela, O. C., & Thoumrungroje, A. (2019). Enhancing export performance through proactive export market development capabilities and ICT utilization. *Journal of Global Marketing*, 1–18. doi:10.1080/08911762.2018.1549302

Rak, J., Papadimitriou, D., Niedermayer, H., & Romero, P. (2017). Information-driven network resilience: Research challenges and perspectives. *Optical Switching and Networking, 23*, 156–178. doi:10.1016/j.osn.2016.06.002

Ramalakshmi, R., & Radhakrishnan, S. (2014). Weighted dominating set based routing for ad hoc communications in emergency and rescue scenarios. *Wireless Networks, 21*(2), 499–512. doi:10.1007/s11276-014-0800-4

Ramani, S., & Mann, K. (2015). Introducing medical educators to qualitative study design: Twelve tips from inception to completion. *Medical Teacher*, 1–8. doi:10.3109/0142159x.2015.1035244

Rasool, S., & Ross, E. (2016). The power and promise of group work. *Research on Social Work Practice, 27*(2), 206–214. doi:10.1177/1049731516653185

Rhodes, R. (2017). When is participation in research a moral duty? *The Journal of Law, Medicine & Ethics, 45*(3), 318–326. doi:10.1177/1073110517737529

Ridder, H.-G. (2017). The theory contribution of case study research designs. *Business Research, 10*(2), 281–305. doi:10.1007/s40685-017-0045-z

Rimando, M., Brace, A. M., Namageyo-Funa, A., Parr, T. L., Sealy, D., Davis, T. L., … Christiana, R. W. (2015). Data collection challenges and recommendations for early career researchers. *The Qualitative Report, 20*(12), 2025-2036. Retrieved from http://nsuworks.nova.edu

Robinson, O. C. (2014). Sampling in interview-based qualitative research: A theoretical and practical guide. *Qualitative research in psychology, 11*(1), 25-41. doi:10.1080/14780887.2013.801543

Roulston, K., & Shelton, S. A. (2015). Reconceptualizing bias in teaching qualitative research methods. *Qualitative Inquiry, 21*(4), 332–342. doi.org/10.1177/1077800414563803

S.524: Maximum permissible levels of off-axis e.i.r.p. density from earth stations in geostationary-satellite orbit networks operating in the fixed-satellite service transmitting in the 6 GHz, 13 GHz, 14 GHz and 30 GHz frequency bands. (2006). Retrieved from https://www.itu.int/

S.1521: Allowable error performance for a hypothetical reference digital path based on synchronous digital hierarchy. (2001). Retrieved from https://www.itu.int

S.2029: Statistical methodology to assess time-varying interference produced by a geostationary fixed-satellite service network of earth stations operating with

MF-TDMA schemes to geostationary fixed-satellite service networks. (2012). Retrieved from https://www.itu.int

Saab, D., Tapia, A., Maitland, C., Maldonado, E., & Tchouakeu, L. (2013). Inter-organizational coordination in the wild: Trust building and collaboration among field-Level ICT workers in humanitarian relief organizations. *Voluntas: International Journal of Voluntary & Nonprofit Organizations, 24*(1), 194-213. doi:10.1007/s11266-012-9285-x

Sabouhi, F., Tavakoli, Z. S., Bozorgi-Amiri, A., & Sheu, J.-B. (2018). A robust possibilistic programming multi-objective model for locating transfer points and shelters in disaster relief. *Transportmetrica A: Transport Science*, 1–28. doi:10.1080/23249935.2018.1477852

Sade, R. M. (2017). Controversies in clinical research ethics. *The Journal of Law, Medicine & Ethics, 45*(3), 291–294. doi:10.1177/1073110517737525

Safa, M., Shahi, A., Haas, C. T., Fiander-McCann, D., Safa, M., Hipel, K., & MacGillivray, S. (2015). Competitive intelligence (CI) for evaluation of construction contractors. *Automation in Construction, 59*, 149–157. doi:10.1016/j.autcon.2015.02.009

Sakano, T., Kotabe, S., Komukai, T., Kumagai, T., Shimizu, Y., Takahara, A., & … Kato, N. (2016). Bringing movable and deployable networks to disaster areas: Development and field test of MDRU. *IEEE Network, 30*(1), 86-91. doi:10.1109/MNET.2016.7389836

Salah, S., Maciá-Fernández, G., Díaz-Verdejo, J., & Sánchez-Casado, L. (2016). A model for incident tickets correlation in network management. *Journal of Network & Systems Management, 24*(1), 57-91. doi:10.1007/s10922-014-9340-6

Sampson, J., Hou, P., Kronholz, J., Dozier, V., McClain, M., Buzzetta, M., … Kennelly, E. (2014). A content analysis of career development theory, research, and practice-2013. *The Career Development Quarterly, 62*(4), 290-326. doi:10.1002/j.2161-0045.2014.00085.x

Sanders, M. R. (2015). Management of conflict of interest in psychosocial research on parenting and family interventions. *Journal of Child & Family Studies, 24*(3), 832-841. doi:10.1007/s10826-015-0127-5

Santhi, S., & Sadasivam, G. (2015). Design and development of compact monitoring system for disaster remote health centres. *Indian Journal of Medical Microbiology, 33*(5), 11. doi:10.4103/0255-0857.150871

Sari, L., & Mahyastuty, V. W. (2013). Interference potential of FSS and BWA on the extended C-Band. *Telkomnika, 11*(2), 373. doi:10.12928/telkomnika.v11i2.939

Satellite Earth Stations and Systems (SES); Reference scenario for the deployment of emergency communications; Part 2: Mass casualty incident in public transportation (2015). European Telecommunications Standards Institute. Retrieved from www.etsi.org

Sayago, S. (2014). The construction of qualitative and quantitative data using discourse analysis as a research technique. *Quality & Quantity, 49*(2), 727–737. doi:10.1007/s11135-014-0020-0

Schwenger, D., Straub, T., & Borzillo, S. (2014). Non-governmental organizations: strategic management for a competitive world. *Journal of business strategy, 35*(4), 11. doi:10.1108/JBS-11-2013-0105

Scrutton, R., & Beames, S. (2015). Measuring the unmeasurable: Upholding rigor in quantitative studies of personal and social development in outdoor adventure education. *Journal of Experiential Education, 38*(1), 8-25. doi:10.1177/1053825913514730

Seddon, P. B. (2014). Implications for strategic IS research of the resource-based theory of the firm: A reflection. *Journal of Strategic Information Systems, 23*(4), 257–269. doi:10.1016/j.jsis.2014.11.001

Shan, S., Luo, Y., Zhou, Y., & Wei, Y. (2018). Big data analysis adaptation and enterprises' competitive advantages: the perspective of dynamic capability and resource-based theories. *Technology Analysis & Strategic Management*, 1–15. doi:10.1080/09537325.2018.1516866

Sharifyazdi, M., Navangul, K. A., Gharehgozli, A., & Jahre, M. (2018). On- and offshore prepositioning and delivery mechanism for humanitarian relief operations. *International Journal of Production Research, 56*(18), 6164–6182. doi:10.1080/00207543.2018.1477260

Sharing studies between international mobile telecommunication-advanced systems and geostationary satellite networks in the fixed-satellite service in the 3 400-4 200 MHz and 4 500-4 800 MHz frequency bands in the WRC study cycle leading to WRC-15. (2015). Retrieved from https://www.itu.int

Sharma, S. K., Chatzinotas, S., & Ottersten, B. (2013). Interference alignment for spectral coexistence of heterogeneous networks. *EURASIP Journal on Wireless Communications and Networking, 2013*(1), 1–14. doi:10.1186/1687-1499-2013-46

Shaw, J. A. (2016). Reflexivity and the "Acting Subject." *Qualitative Health Research, 26*(13), 1735–1744. doi:10.1177/1049732316657813

Smart sustainable development model (SSDM) report 2016. (2016). Retrieved from https://www.itu.int

Smith, V., Bethune, C., & Hurley, K. F. (2017). Examining medical student specialty choice through a gender lens: An orientational qualitative study. *Teaching and Learning in Medicine, 30*(1), 33–44. doi:10.1080/10401334.2017.1306447

Šnipas, M., Radziukynas, V., & Valakevičius, E. (2018). Numerical solution of reliability models described by stochastic automata networks. *Reliability Engineering & System Safety, 169*, 570–578. doi:10.1016/j.ress.2017.09.024

Solmaz, D., Gunduz, O., Akar, S., Can, G., Birlik, M., Akkoc, Y., … Akkoc, N. (2015). Telephone interview strategy can be used for screening

inflammatory back pain in the community. *International Journal of Rheumatic Diseases*, *20*(1), 33–38. doi:10.1111/1756-185x.12587

Song, W., Yu, H., & Qu, Q. (2018). High involvement work systems and organizational performance: the role of knowledge combination capability and interaction orientation. *The International Journal of Human Resource Management*, 1–25. doi:10.1080/09585192.2018.1539863

Sousa, E., Lins, F., Tavares, E., Cunha, P., & Maciel, P. (2015). A modeling approach for cloud infrastructure planning considering dependability and cost requirements. *IEEE transactions on systems, man & cybernetics: Systems*, *45*(4), 549-558. doi:10.1109/TSMC.2014.2358642

Spencer, S.-J. (2017). Striving for balance between participation and protection in research involving prison populations. *Australian & New Zealand Journal of Psychiatry*, *51*(10), 974–976. doi:10.1177/0004867417714880

Stathakis, A., Danoy, G., Bouvry, P., Talbi, E.-G., & Morelli, G. (2015). Optimizing communication satellites payload configuration with exact approaches. *Engineering Optimization*, *47*(12), 1709–1734. doi:10.1080/0305215x.2014.995176

Steyn, E., Poggenpoel, M., & Myburgh, C. (2017). Lived experiences of parents of premature babies in the intensive care unit in a private hospital in Johannesburg, South Africa. *Curationis*, *40*(1). doi:10.4102/curationis.v40i1.1698

Sundqvist, C. (2018). Facilitators and pitfalls in the use of consultation strategies: Prospective special educators' self-reflections on audio-recorded consultation sessions. *Journal of Educational and Psychological Consultation*, 1–30. doi:10.1080/10474412.2018.1470933

Sung, S. Y., & Choi, J. N. (2016). To invest or not to invest: strategic decision making toward investing in training and development in Korean manufacturing firms. *The International Journal of Human Resource Management, 29*(13), 2080–2105. doi:10.1080/09585192.2016.1239215

Suri, H. (2011). Purposeful sampling in qualitative research synthesis. *Qualitative Research Journal, 11*(2), 63–75. doi:10.3316/qrj1102063

Syssner, J., & Meijer, M. (2017). Informal planning in depopulating rural areas. *European Countryside, 9*(3). doi:10.1515/euco-2017-0027

Takata, H. (2016). Effects of industry forces, market orientation, and marketing capabilities on business performance: An empirical analysis of Japanese manufacturers from 2009 to 2011. *Journal of Business Research, 69*(12), 5611–5619. doi:10.1016/j.jbusres.2016.03.068

Ţarcă, N. (2015). The way in which the graduates of higher education economic uses Microsoft Excel in the marketing activities of the companies in Bihor county. *Annals of The University of Oradea, Economic Science Series, 24*(2), 627-633. Retreived from http://anale.steconomiceuoradea.ro

Tavakol, M., & Sandars, J. (2014a). Quantitative and qualitative methods in medical education research: AMEE Guide No 90: Part I. *Medical Teacher,*

36(9), 746-756. doi:10.3109/0142159X.2014.915298

Tavakol, M., & Sandars, J. (2014b). Quantitative and qualitative methods in medical education research: AMEE Guide No 90: Part II. Medical Teacher, 36(10), 838-848. doi:10.3109/0142159X.2014.915297

Teece, D. J. (2014). The foundations of enterprise performance: Dynamic and ordinary capabilities in an (economic) theory of firms. *Academy of Management Perspectives, 28*(4), 328–352. doi:10.5465/amp.2013.0116

Teece, D. J. (2017). A capability theory of the firm: an economics and (strategic) management perspective. *New Zealand Economic Papers, 53*(1), 1–43. doi:10.1080/00779954.2017.1371208

Teixeira, M., Ribeiro, R., Oliveira, C., & Massa, R. (2015). A quality-driven approach for resources planning in Service-Oriented Architectures. *Expert Systems with Applications, 42*(12), 5366–5379. doi:10.1016/j.eswa.2015.02.004

Teixeira Vinci, A. L., Lopes Rijo, R. P. C., de Azevedo Marques, J. M., & Alves, D. (2017). Development and proposal of a reference tool for semi-structured interviews for the characterization of the management in mental health networks. *Procedia Computer Science, 121*, 511–518. doi:10.1016/j.procs.2017.11.068

Tengyue, M., Bin, Z., & Zhengquan, X. (2014). A multi-QoS optimization routing for LEO/MEO satellite IP networks. *Journal of Multimedia, 9*(4), 576-582. doi:10.4304/jmm.9.4.576-582

Thomas, D. R. (2016). Feedback from research participants: are member checks useful in qualitative research? *Qualitative Research in Psychology, 14*(1), 23–41. doi:10.1080/14780887.2016.1219435

Toye, G., Sheppard, S., & Chen, H. L. (2016). Data sharing and reuse within the academic pathways study. *Advances in Engineering Education, 5*(2). Retreived from http://advances.asee.org/

Tran, H. T., Domerçant, J. C., & Mavris, D. N. (2016). A network-based cost comparison of resilient and robust system-of-systems. *Procedia Computer Science, 95*, 126–133. https://doi.org/10.1016/j.procs.2016.09.302

Trantopoulos, K., von Krogh , G., Wallin, M. W., & Woerter, M. (2017). External knowledge and information technology: Implications for process innovation performance. *MIS Quarterly, 41*(1), 287–300. doi:10.25300/misq/2017/41.1.15

Treacy, R., Humphreys, P., McIvor, R., & Lo, C. (2019). ISO14001 certification and operating performance: A practice-based view. *International Journal of Production Economics, 208*, 319–328. doi:10.1016/j.ijpe.2018.12.012

Truyens, J., De Bosscher, V., Heyndels, B., & Westerbeek, H. (2013). A resource-based perspective on countries' competitive advantage in elite athletics. *International Journal of Sport Policy and Politics, 6*(3), 459–489. doi:10.1080/19406940.2013.839954

Tseng, M.-L., Islam, M. S., Karia, N., Fauzi, F. A., & Afrin, S. (2019). A literature review on green supply chain management: Trends and future challenges.

Resources, Conservation and Recycling, *141*, 145–162. doi:10.1016/j.resconrec.2018.10.009

Tsou, H.-T., Cheng, C. C. J., & Hsu, H.-Y. (2015). Selecting business partner for service delivery co-innovation and competitive advantage. *Management Decision, 53*(9), 2107–2134. doi:10.1108/md-01-2015-0014

Turner, S. F., Cardinal, L. B., & Burton, R. M. (2016). Research design for mixed methods. *Organizational Research Methods*, *20*(2), 243–267. doi:10.1177/1094428115610808

Turulja, L., & Bajgorić, N. (2016). Innovation and information technology capability as antecedents of firms success. *Interdisciplinary Description of Complex Systems, 14*(2), 148-156. doi:10.7906/indecs.14.2.4

Tuval-Mashiach, R. (2017). Raising the curtain: The importance of transparency in qualitative research. *Qualitative Psychology*, *4*(2), 126–138. doi:10.1037/qup0000062

Ummel, D., & Achille, M. (2016). How not to let secrets out when conducting qualitative Research with dyads. *Qualitative Health Research*, *26*(6), 807–815. doi:10.1177/1049732315627427

Use of very small aperture terminals (VSATs). (2013). Retrieved from https://www.itu.int

Uwizeyemungu, S., Raymond, L., Poba-Nzaou, P., & St-Pierre, J. (2018). The complementarity of IT and HRM capabilities for competitive performance: a configurational analysis of manufacturing and industrial service SMEs.

Enterprise Information Systems, 12(10), 1336–1358. doi:10.1080/17517575.2018.1448118

Vafeas, M. (2015). Account manager turnover and the influence of context: an exploratory study. *Journal of Business & Industrial Marketing, 30*(1), 72–82. doi:10.1108/jbim-04-2012-0064

Van Rijnsoever, F. J. (2017). (I Can't Get No) Saturation: A simulation and guidelines for sample sizes in qualitative research. *PLOS ONE, 12*(7), e0181689. doi:10.1371/journal.pone.0181689

Van Wijk, E., Traut, A., & Julie, H. (2014). Environmental and nursing-staff factors contributing to aggressive and violent behaviour of patients in mental health facilities. *Curationis, 37*(1). doi:10.4102/curationis.v37i1.1122

Varpio, L., Ajjawi, R., Monrouxe, L. V., O'Brien, B. C., & Rees, C. E. (2016). Shedding the cobra effect: problematising thematic emergence, triangulation, saturation and member checking. *Medical Education, 51*(1), 40–50. doi:10.1111/medu.13124

Vierhout, M., Daniels, M., Mazzotta, P., Vlahos, J., Mason, W. P., & Bernstein, M. (2017). The views of patients with brain cancer about palliative care: a qualitative study. *Current Oncology, 24*(6), 374. doi:10.3747/co.24.3712

Vinayak, R., Krishnaswamy, D., & Dharmaraja, S. (2013). Analytical modeling of transmission control protocol newreno using generalized stochastic petri nets. *International Journal of Communication Systems, 27*(12), 4185–4198.

doi:10.1002/dac.2605

Voyer, S., Cuncic, C., Butler, D. L., MacNeil, K., Watling, C., & Hatala, R. (2016). Investigating conditions for meaningful feedback in the context of an evidence-based feedback programme. *Medical Education, 50*(9), 943–954. doi:10.1111/medu.13067

Vuso, Z., & James, S. (2017). Effects of limited midwifery clinical education and practice standardisation of student preparedness. *Nurse Education Today, 55*, 134–139. doi:10.1016/j.nedt.2017.05.014

Wang, C.-H., Chang, C.-H., & Shen, G. C. (2015). The effect of inbound open innovation on firm performance: Evidence from high-tech industry. *Technological Forecasting and Social Change, 99*, 222–230. doi:10.1016/j.techfore.2015.07.006.

Wang, M., Yuan, B., Kirschner, P. A., Kushniruk, A. W., & Peng, J. (2018). Reflective learning with complex problems in a visualization-based learning environment with expert support. *Computers in Human Behavior, 87*, 406–415. doi:10.1016/j.chb.2018.01.025

Wang, Y., Xu, Y., Zhang, Y., & Zhang, P. (2017). Hybrid satellite-aerial-terrestrial networks in emergency scenarios: a survey. *China Communications, 14*(7), 1–13. doi:10.1109/cc.2017.8010971Webster, M. (2016). Examining philosophy of technology using grounded theory methods. *Forum Qualitative Sozialforschung / Forum: Qualitative Social Research, 17*(2). doi.org/10.17169/fqs-17.2.2481

Ward, K., Gott, M., & Hoare, K. (2015). Participants' views of telephone interviews within a grounded theory study. *Journal of Advanced Nursing, 71*(12), 2775–2785. doi:10.1111/jan.12748

Webster, M. (2016). Examining philosophy of technology using grounded theory methods. Forum Qualitative Sozialforschung / Forum: *Qualitative Social Research, 17*(2). doi.org/10.17169/fqs-17.2.2481

Weerackody, V. (2016). Sensitivity of satellite interference to locations of small-aperture terminals. *IEEE transactions on aerospace & electronic systems, 52*(1), 245-260. doi:10.1109/TAES.2015.140425

Welsh, D. H. B., Kaciak, E., & Shamah, R. (2018). Determinants of women entrepreneurs' firm performance in a hostile environment. *Journal of Business Research. 88*, 481-491. doi:10.1016/j.jbusres.2017.12.015

Wernerfelt, B. (1984). A resource-based view of the firm. *Strategic Management Journal, 5*(2), 171-180. doi:10.1002/smj.4250050207

Wessels, J. S., & Visagie, R. G. (2017). The eligibility of public administration research for ethics review: A case study of two international peer-reviewed journals. *International Review of Administrative Sciences*, 83156-176. doi:10.1177/0020852315585949

Whalon, K. J., Conroy, M. A., Martinez, J. R., & Werch, B. L. (2015). School-based peer-related social competence interventions for children with autism Spectrum disorder: A meta-analysis and descriptive review of single case research design studies. *Journal of Autism and Developmental Disorders,*

45(6), 1513–1531. doi:10.1007/s10803-015-2373-1

White, K. (2017). Minding the gaps: Interprofessional communication and the stewardship of oral histories with sensitive information. *Journal of Academic Librarianship, 43*(4), 354–363. doi:10.1016/j.acalib.2017.06.007

Wibowo, A., & Handika, R. F. (2017). The strategy of the banking industry in Indonesia: following institutional theory or resource-based view? *Jurnal Siasat Bisnis, 21*(2), 131–141. doi:10.20885/jsb.vol21.iss2.art3

Wikhamn, W. (2019). Innovation, sustainable HRM and customer satisfaction. *International Journal of Hospitality Management, 76*, 102–110. doi:10.1016/j.ijhm.2018.04.009

Wilden, R., & Gudergan, S. (2015). The impact of dynamic capabilities on operational marketing and technological capabilities: investigating the role of environmental turbulence. *Journal of the Academy of Marketing Science, 43*(2), 181-199. doi:10.1007/s11747-014-0380-y

Wilk-Jakubowski, J. (2018). Predicting satellite system signal degradation due to rain in the frequency range of 1 to 25 GHz. *Polish Journal of Environmental Studies, 27*(1), 391–396. doi:10.15244/pjoes/73906

Williams, L. K., & McCarthy, M. C. (2014). Parent perceptions of managing child behavioural side-effects of cancer treatment: a qualitative study. *Child: Care, Health and Development, 41*(4), 611–619. doi:10.1111/cch.12188

Windsong, E. A. (2016). Incorporating intersectionality into research design: an example using qualitative interviews. *International Journal of Social*

Research Methodology, 21(2), 135–147. doi:10.1080/13645579.2016.1268361

Wong, W. P., & Tang, C. F. (2018). The major determinants of logistic performance in a global perspective: evidence from panel data analysis. *International Journal of Logistics Research and Applications, 21*(4), 431–443. doi:10.1080/13675567.2018.1438377

Wu, J., & Olk, P. (2014). Technological advantage, alliances with customers, local knowledge and competitor identification. *Journal of business research, 67*(10), 2106–2114. doi:10.1016/j.jbusres.2014.04.019

Xie, X., Wang, W., & Luan, K. (2014). It is not what we have, but how we use it: Reexploring the relationship between task conflict and team innovation from the resource-based view. *Group Processes & Intergroup Relations, 17*(2), 240-251. doi:10.1177/1368430213502559

Xu, X., Chen, A., Jansuwan, S., Yang, C., & Ryu, S. (2018). Complementary measures and computational methods. *Transportation Research Part B: Methodological, 114,* 68–85. doi:10.1016/j.trb.2018.05.014

Yan, R., Lu, B., & Li, X. (2018). On redundancy allocation to series and parallel systems of two components. *Communications in Statistics - Theory and Methods*, 1–12. doi:10.1080/03610926.2018.1500603

Yang, T., Xun, J., & He, X. (2015). British SMEs' e-commerce technological investments and firm performance: an RBV perspective. *Technology*

Analysis & Strategic Management, *27*(5), 586–603. doi:10.1080/09537325.2015.1019453

Yao, X., Huang, R., Song, M., & Mishra, N. (2018). Pre-positioning inventory and service outsourcing of relief material supply chain. *International Journal of Production Research*, 1–13. doi:10.1080/00207543.2018.1495853

Yeh, C.-T., & Fiondella, L. (2017). Optimal redundancy allocation to maximize multi-state computer network reliability subject to correlated failures. *Reliability Engineering & System Safety*, *166*, 138–150. doi:10.1016/j.ress.2016.08.026

Yoon, J., Kim, Y., Vonortas, N. S., & Han, S. W. (2017). Corporate foresight and innovation: the effects of integrative capabilities and organisational learning. *Technology Analysis & Strategic Management*, *30*(6), 633–645. doi:10.1080/09537325.2017.1395407

Yu, W., Chavez, R., Jacobs, M. A., & Feng, M. (2018). Data-driven supply chain capabilities and performance: A resource-based view. *Transportation Research Part E: Logistics and Transportation Review*, *114*, 371–385. doi:10.1016/j.tre.2017.04.002

Zamanzadeh, V., Ahmadi, F., Foolady, M., Behshid, M., & Irajpoor, A. (2017). The health seeking behaviors and perceptions of Iranian patient with osteoarthritis about pain management: A qualitative study. *Journal of Caring Sciences*, *6*(1), 81–93. doi:10.1517

Zardini, A., Rossignoli, C., & Ricciardi, F. (2016). A bottom-up path for IT

management success: From infrastructure quality to competitive excellence. *Journal of Business Research, 69*(5), 1747–1752. doi:10.1016/j.jbusres.2015.10.049

Zhu, H., & Li, P. (2018). Dancing in shackles: interactive learning of industrial design firms in Beijing. *Industry and Innovation*, 1–24. doi:10.1080/13662716.2018.147324

Zhou, H., Jong, M., & Lo, G. (2015). Evolution of satellite communication antennas on mobile ground terminals. *International Journal of Antennas & Propagation*, *2015*, 1-14. doi:10.1155/2015/436250

Zyphur, M., & Pierides, D. (2017). Is quantitative research ethical? Tools for ethically practicing, evaluating, and using quantitative research. *Journal of Business Ethics, 143*(1), 1-16. doi:10.1007/s10551-017-3549-8

Appendix A: Organizational Permission

[redacted]

June 1, 2018

Dear Charles Lomotey,

I give permission for you to conduct the study entitled "Strategies to recover from satellite communication failures" [redacted] As part of this study, I authorize you to:

1. Identify potential participants who have undergone [redacted] Training [redacted] from the organization's Intranet
2. Contact and interview those who work in level 3 emergencies and agree to participate
3. Contact the participants again after the interviews have been transcribed to have their agreement that the contents reflect their previous discussions, and clarify any issues
4. Triangulate the results with statistics from the [redacted] security gateways to ascertain the effectiveness of the strategies. The information required would be bandwidth utilization, [redacted], availability, latency and packet losses. These statistics can be obtained either from the participants who already have access to this information, or from the firewall/network administrator [redacted] who has oversight of the Security Gateways
5. Disseminate the results to the participants and any other groups I may identify

In addition, note that:

6. All queries and data collection will be routed through [redacted]
7. All such queries will be logged and documented as part of the project
8. The list of interviewees and participants will be submitted and reviewed by [redacted] ahead of time

Individuals' participation will be voluntary and at their discretion.

We understand that our organization's responsibilities include: Access to individuals who agree to participate in the study, access to network management statistics in the [redacted] Security Gateways (bandwidth utilization, [redacted], availability, latency and packet losses. We reserve the right to withdraw from the study at any time if our circumstances change.

I understand that the student will not be naming our organization, participants, vendors, and equipment in the doctoral project report that is published in Proquest.

I confirm that I am authorized to approve research in this setting. I understand that the data collected will remain entirely confidential and may not be provided to anyone outside of the student's supervising faculty/staff without permission from the Walden University IRB.

Sincerely,

[redacted]

Chief Information Officer [redacted]

Appendix B: Interview Protocol

1. Record the date, time, location and name of the participant.
2. Introduce myself as the researcher to the participant.
3. Request that the informed consent form is completed, endorsed and shared before proceeding.
4. Briefly inform the participant that the interview is voluntary and that he or she can choose to discontinue the interview at any point; inform them that ABC, the Chief of DEF at XYZ reviewed my list of potential participants. Also, reassure the participant that the interview is confidential and their identities will not be disclosed in any report or publication related to this study.
5. Describe the purpose of the study to identify strategies used to recover from satellite communication failures. The focus of the study being network administrators working in disaster-relief or humanitarian environments.
6. Describe the benefits of the study which would be used to improve disaster recovery and business continuity processes.
7. Inform the participant that the interview is about to start and is being recorded for transcription.
8. Ask the interview questions, and include follow up questions for clarifications
9. Inform the participant that the network monitoring statistics will be

requested through Mr. ABC, the Chief of DEF. This will ensure that any information I collect will not compromise the security of the network. The data collected will be used to buttress their points.

10. Inform the participant that the interview has ended and if he or she would like to ask any questions.
11. Inform the participant after transcription, I will have a follow up Interview for clarifications and to ensure the information captured is correct.

Thank the participant for their time

Appendix C: Copyrights

Hamid, Z. A., Tariq, K. R., Majed, M. B., & Rahm, T. D. (2015). Spectrum investigation for sharing analysis between BWA system and FSS receiver. *Journal of theoretical and applied information technology. 81*(2), 166. A large number of manuscript inflows, reflects its popularity and the trust of world's research community. JATIT is indexed with major indexing and abstracting organizations and is published in both electronic and print format.