Mitigating Supply Chain Disruptions,
Risks, and Vulnerabilities

by

John Kim

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Doctoral Study Submitted in Partial Fulfillment
of the Requirements for the Degree of
Doctor of Business Administration

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Liberty University, School of Business

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Section 1: Foundation of the Study

The supply chain industry has made significant strides in improving efficiency of procedures and processes. The implementation of cyberinfrastructure is one of the major contributors to the improvement of efficiency but has also increased the vulnerabilities that, if not addressed, would result in disruptions (Forte et al., 2016). Disruptions negatively impact supply chain businesses to a severe degree that also affects the economy, hence the need for improved supply chain security. This research focused on observing past studies on enhancing supply chain security and applying strategies implemented to the recent examples of cyberattacks that have disrupted supply chain operations in West Coast ports. The result of this study could provide useful insights and information on how to reduce the risks and negative impacts of disruptions through strategies like implementing a lean and resilient design or emphasizing quality management.

Background of the Problem

Despite advances made in technology and procedures in the supply chain industry, supply chain disruptions still occur for various reasons and have severe consequences on supply chain businesses and customers (Haloukas, 2019). However, one particular source of these disruptions that is most worrisome is the potential vulnerabilities in supply chain security. Since the supply chain industry is very crucial to the global economy, criminals, terrorists, and other groups that wish to harm society see the supply chain industry as a very appealing target to attack (Leonard et al., 2015). These attacks could cause disruptions of various levels that would severely affect the businesses involved and the customers they serve. One example of these disruptions caused by criminals is the recent cyberattack on Maersk that resulted in a loss of $300 million in damages and reinstallation of technology in order to resume operations (Cimpanu, 2018).
Therefore, management in supply chain organizations need to seek out continuous improvements and addressing of vulnerabilities in supply chain security in order to avoid the long-term negative effects that disruptions caused by external forces can have on supply chain performance (Haloukas, 2019).

**Problem Statement**

The general problem to be addressed is the lack of enhanced security in the supply chain industry, resulting in disruptions that negatively impact supply chain businesses and customers. Forte et al. (2016) stated that complex design flaws of the cyberinfrastructure can cause disruptions in the supply chain, resulting in the need for stronger cybersecurity practices. Khan et al. (2018) stated that the threat of terrorism poses disruptions in the supply chain; therefore, increasing the need for more effective strategies on counterterrorism for supply chain security is required. Park et al. (2016) stated that cyberattacks or natural disasters cause supply chain disruptions that can cause declining sales, cost increases, and service failures for companies, resulting in the need to enhance security practices in the supply chain industry. The specific problem addressed is how the supply chain can easily be disrupted by numerous factors other than hackers and terrorists, and how supply chain disruptions majorly impact supply chain businesses and customers.

**Purpose Statement**

The purpose of this qualitative case study was to understand the various ways the supply chain industry incurs disruption from the lack of enhanced security and the development of potential ideas on how disruptions receive mitigation. The shipping ports in the western region of the United States have seen several cyberattacks in recent years, which resulted in disruptions that have negatively impacted supply chain businesses and their customers. The cyberattacks on
the shipping ports are clear examples of how minimal amounts of attack on the supply chain is still impactful in disrupting supply chain processes, such as how the cyberattack on the Port of San Diego limited employees’ access to computers, thereby causing public inconvenience for business purposes (Ng, 2018). The cyberattacks on the west coast ports inspired the purpose of this study, which was to understand why the supply chain industry incurs disruptions and how supply chain organizations can address, mitigate, and overcome the impact of disruptions. The result of this study could provide insight to the issue of the vulnerabilities in supply chain security and develop potential ideas for more efficient supply chain security practices, which could result in higher long-term productivity (Adams, 2018).

**Nature of the Study**

The issue addressed in this research was the numerous ways the supply chain industry was vulnerable to disruptions, in which the results negatively impact supply chain businesses and customers. This issue resulted in the questions on what measures can be developed and implemented to improve upon this issue. As such, a case study methodology with a pragmatism paradigm is appropriate. The issue of supply chain disruptions because of the lack of enhanced security is a flexible issue that is constantly changing, which can reflect from the cyberinfrastructure adopted many years prior (Forte et al., 2016). However, this research also accounted for the main limitation of the case study methodology in that the methodology did not have numerous cases (Manhart, 2017). As seen in Section 3 of this study, eleven participants of various business and location were selected compared to Haloukas’s (2019) nine participants from five Fortune 500 companies in the northeastern United States, although not nearly as numerous as Manhart’s (2017) 52 participants after some reduction based on whether firms met Manhart’s inclusion criteria.
Discussion of Method

The use of the qualitative methodology was appropriate for the issue of supply chain disruptions caused by the lack of enhanced security because of the flexible design of qualitative research in general. While the quantitative methodology has the advantage of deductive reasoning as opposed to the inductive nature of the qualitative methodology, qualitative research was ideal in understanding a phenomenon by answering research questions through interactions with the participants involved in that phenomenon (Haloukas, 2019). Quantitative research focuses on examining the relationship between the independent and dependent variables, usually through statistical means (Morgan et al., 2013). Furthermore, researchers use quantitative methodology for research in which the data emerge in a quantifiable manner, which is not prevalent for the topic of enhanced security and disruption mitigation in the supply chain industry. Therefore, a mixed method research was not appropriate because the methodology contained elements of a quantitative research, which left the qualitative research methodology as the implementation strategy for this research.

Discussion of Design

The case study methodology included the focus of qualitative research in order to better understand the situation and phenomena associated with the topic through research questions and in-depth examinations of the different cases, such as the recent examples of supply chain disruptions with negative impact on businesses and customers (Brown, 2020). The events surrounding the issues involved people, their activities, company policies, and how these components interacted. All were examined to provide a better perspective of how everything worked, the origins of the issues, and the potential solutions developed for the issues (Brown, 2020). While quantitative methods are ideal to examine relationships and differences between
variables, qualitative methods are more appropriate for exploring strategies utilized to mitigate the issues addressed (Bondwe, 2019).

The phenomenological methodology was ideal in understanding the lived experiences of the individuals of a phenomenon, which could be applicable to the workers of supply chain businesses that suffered disruptions (Bondwe, 2019). However, the phenomenological approach had the risk of expanding beyond the limited scope intended for this research and losing focus of the intended study, which was to gain the knowledge from the participants on successful prevention and mitigation of supply chain disruptions. The ethnographic research design was inapplicable for this research because of the focus on successful strategies to mitigate supply chain disruption while the ethnographic method is designed to explore in detail the cultural characteristics of the work environment. Finally, the grounded methodology received consideration because of the design in data collection being appropriate for this research, but the focus was strictly on developing and improving upon existing strategies to mitigate supply chain disruptions rather than developing theoretical inquiries in new areas of supply chain security (Mayounga, 2017). Therefore, the case study methodology was the appropriate method for this research.

The research paradigm that was used in conjunction with the case study methodology was pragmatism because the study did not include a specific philosophy or reality, making pragmatism the most versatile in terms of perspective. As established previously, supply chain security is a topic that is constantly evolving, especially because of the adoption of the cyberinfrastructure providing numerous avenues in improving efficiency and disrupting the economy. Therefore, pragmatism is an important and appropriate research paradigm that can
accommodate the need for flexibility by way of the use of mixed methods with a clear focus on what works best (Kaushik & Walsh, 2019).

As for the participants in this research, the main actors involved groups that contributed to this study (e.g. people, organizations, etc.). Since the main topic of this study was supply chain security, human participants consisted of high-level employees and managers in the supply chain industry in order to learn about the mindset behind the implementation of certain security practices in the supply chain, as well as their short- and long-term impact. The research included participants from various businesses and locations to understand the key factors and variables that may affect data collection, such as changes in policies and procedures, potential bias from interviews, or different leadership styles in each organization. The purpose behind this focus was to gain first-hand accounts via interviews of the impact the disruptions have had on the organization and the employees who work for these organizations, as well as the measures taken to recuperate from any losses and resume operations.

Summary of the Nature of the Study

Qualitative studies are preferable when wanting to understand the issue and key elements that contribute toward the issue through the participants’ experiences (Haloukas, 2019). This research methodology provides first-hand accounts on the issue, the organization affected, and potential solutions and strategies that are developed and implemented to address the issue. Despite qualitative research methods favoring inductive reasoning, the first-hand accounts of multiple participants offset the potential setback of the lack of deductive reasoning, which then ensures validity and reliability in the research.
Research Questions

In any research project, asking, addressing, and studying upon the right research questions is crucial. The research questions for this study are as follows:

RQ1: Why is the supply chain industry lacking enhanced security?
   - RQ1a: What factors have contributed to the success in supply chain security?
   - RQ1b: What factors have contributed to the failures in supply chain security?

RQ2: What strategies can supply chain industries implement to reduce disruptions?
   - RQ2a: What strategies have worked against supply chain disruptions?
   - RQ2b: What strategies have aggravated the negative results of supply chain disruptions?

RQ3: How can businesses work to both implement and maintain the strategies that minimize supply chain disruptions?

Since the main problem addressed in the problem statement was the lack of strong security in the supply chain industry, the first question addressed why it was considered as such in order to understand the importance of the situation and begin researching for a solution. The sub-questions explored what constituted success and failure concerning supply chain security in order to contribute to the main research question. The first research question addressed the why of the situation, which resulted in the second question addressing the potential steps that can be taken to find a solution to the problem. Since this study involved a qualitative case study methodology, the answers to this question mainly consisted of inductive reasoning derived from ideas and other potential solutions for supply chain risk mitigation based on current research.

With the first two research question focused on understanding the situation and delving into potential ideas for solutions, the third research question addressed the previous in how the solutions were to be implemented and maintained in order to mitigate supply chain disruptions.
The specific problem statement aligned on various supply chain organizations. Although this study initially started on the recent string of cyberattacks on the western region of the U.S., the numerous ways that supply chain organizations can be disrupted and suffer the negative impact served as a catalyst for the need for supply chain organizations to improve methods, procedures, and security to mitigate the risks and impact of disruptions, as well as recovering from disruptions.

**Conceptual / Theoretical Framework**

As established previously, the main concept of this research was the need for better measures in the supply chain industry to reduce disruptions in the supply chain. As such, the general systems theory applied in this research. The general systems theory is commonly used to propose foundational theories based on the principles of general systems to understand systematic structure and behaviors in various fields (Rousseau, 2015). The general systems theory is also used to help understand the relationships between individual parts of the supply chain and the external environment (Dey, 2016). Applying the general systems theory was most appropriate when dealing with the issue of supply chain disruptions. Disruptions can negatively impact supply chain businesses and customers in various ways, such as reduced sales, cost increases, and service failures (Park et al., 2016). Some of these disruptions can occur from vulnerabilities created by complexities along the supply chain, which can have dire consequences on the economy and human life (Forte et al., 2016).

**Qualitative Studies**

The agency theory was another theory that can be used in a qualitative study, as the purpose of the agency theory is to help understand the relationship between the agents and principals to avoid any risks in businesses related to them because of differing goals (Haloukas,
The agency theory can also analyze the relationship between the government and supply chain businesses representing the principal and agents respectively (Belzer & Swan, 2011). Another theory that can also be used in a qualitative study is the contingency theory, which can help understand how situational factors affect the relationship between independent and dependent variables (Haloukas, 2019). For example, the independent variable is the different strategies implemented to avoid organizational problems while the dependent variable represents how problems are appropriately addressed by the strategies. The contingency theory also has its uses in integrating micro- and macro-level properties to explain various managerial decisions in supply chain management, similar to the agency theory because of its focus on the relationship between human agents and decisions that influence the supply chain industry (Tangpong, 2019). The major difference between the agency and contingency theory is that the former does not account for the risk aversion and self-interest seeking variables of the human agents while the latter does.

With the theories established for the conceptual framework, a diagram was formed to organize the theories and elements of those theories to display the relationship between them, which can be seen in Figure 1 below:
Definitions of Terms

*Lean management:* Lean management is a method in quality management with a flexible design fit for adapting to different situations for improving efficiency and product variety through minimized defects and inventories (Abdallah et al., 2019).
**Performance measurement:** Performance measurement is the form of metrics to measure performance of employees on all levels in all operational areas and has become a common requirement for many supply chain businesses (Mangan et al., 2012).

**Quality management:** Quality management is the method for achieving, maintaining, and improving quality necessary for improving business, meeting customer needs and expectations, and ensuring competitiveness (Plenert, 2012).

**Resilient supply chain:** Resilient supply chain is a supply chain with a dynamic design suited for adapting to the rapid changes in the supply chain industry mostly driven by customer demand while accounting for factors that can disrupt the supply chain (Elluru et al., 2019).

**Supply chain disruption:** Supply chain disruption is a sudden occurrence in which supply chain operations halt because of internal and external factors such as natural disasters, human error, or terrorism, and has adverse effects on the supply chain industry and economy (Meredith & Shafer, 2019).

**Supply chain security:** Supply chain security is the systematic approach in developing practices to prevent or mitigate disruptions and risks to the supply chain industry and to establish conditions and procedures for stable supply chain operations (Christopher, 2015).

### Assumptions, Limitations, and Delimitations

#### Assumptions

No research is perfect with every question answered, which means that assumptions are applied to address a question with subjective reasoning (Bondwe, 2019). The first assumption of this research was that the case study methodology was the most suitable and applicable based on the body of existing literature at the time. The second assumption was that participants would elaborate and answer questions honestly. To ensure honest and quality answers, a safe
environment was created to guarantee anonymity and confidentiality for each participant (Petrova et al., 2016). The final assumption was that the participants in this research, which included employees and management of supply chain businesses, were aware of their company’s business practices and strategies in reducing risks of supply chain disruptions (Haloukas, 2019).

**Limitations**

Limitations in research studies are the potential weaknesses that can affect the research (Dey, 2016). Limitations exist in any research but need minimizing to ensure validity and credibility. The main limitation of this research was the potential bias from the answers provided by the participants. To mitigate the potential bias, the participants were assured of confidentiality regarding personal information and critical details of the companies involved. Another limitation was the participants’ availability. In addition to the geographical distance between the researcher and participants as well as availability for scheduling, the COVID-19 pandemic limited flexibility in conducting interviews. For consideration of the participants’ schedules and safety, the initial contact with participants was initiated via email with the provision of the questionnaires (see Appendix A) while the interviews were scheduled and conducted via voice chat. To guarantee in-depth discussions needed for the case study, consistent contact with the participants was maintained to ensure detailed answers for the research questions. Furthermore, email allowed the participants to think more about their answers and then properly articulate them through text before the scheduled voice chat interview, therefore simplifying the interview process.

**Delimitations**

Delimitations are deliberate limitations set by the researcher to provide a narrower scope and focus for the research (Haloukas, 2019). Therefore, the main delimitation of this research
was the general focus on supply chain practices and measures to mitigate disruptions both anticipated and occurred. As stated previously, the focus of this research was inspired by the significant impact of even minimal level cyberattacks on the west coast ports. Therefore, the intent for this delimitation was to keep the focus on the need for effective and up-to-date supply chain practices and measures. To ensure validity in the data collection, the focus remained narrow on the aforementioned examples and the measures that were taken to mitigate vulnerabilities and risks of another cyberattack.

**Significance of the Study**

The topic of supply chain security is constantly evolving because of the numerous changes in the world, which affects society, customer preferences, technology, procedures, and culture. Therefore, this research was significant in both assessing the impact of the changes affecting the supply chain industry and connecting the impact to the procedures of the supply chain industry designed to improve the processes and security. The recent string of ransomware attacks on major ports in the West Coast raised concerns about supply chain security and measures to mitigate disruptions; hence the focus of this research was mitigating supply chain disruption risks and impact (Cimpanu, 2018). Ransomware attacks represent one of many methods that can cause disruptions in the supply chain industry, which are harmful to both supply chain businesses and customers.

Another cause of disruptions can come from within supply chain organizations, such as outdated and inefficient processes that create vulnerabilities that can be exploited intentionally and unintentionally to further harm supply chain business (Forte et al., 2016). Sometimes, disruptions can occur from measures intended to improve supply chain security that have unforeseen drawbacks, such as increasing the cost of contracts in exchange for higher security.
measures in counterterrorism (Khan et al., 2018). Cybersecurity is a common modern example in the vulnerabilities created by complex procedures and measures that can have unintended side effects that prove to be harmful in the long term (Dey, 2016). This research is significant for further exploring into the past and current status of supply chain security and to use the information to develop potential solutions in mitigating risks of disruptions in the supply chain industry. Information from the past can provide insight into what strategies were ideal and potentially inspire efficient strategies to improve supply chain security.

Reduction of Gaps

As established previously, this research assessed recent examples of supply chain businesses negatively impacted by disruptions. The recent string of cyberattacks on major West Coast ports resulted in losses that affected both business and customers, which raised concern about the state of security in the supply chain industry, particularly with cybersecurity. The findings of this study could contribute to the body of knowledge in supply chain management and logistics, thereby potentially reducing the gap in the literature.

Implications for Biblical Integration

In both religious and non-religious context, the human race strives for better quality in both giving and receiving. The core concept of Keller and Alsdorf’s (2012) book is service to other people as a means to serve the Christian God, and the major criteria emphasized by the authors is quality. In this research, two major concepts exist that can also be applied biblically, which are the production of higher quality for others and to defend from enemies who seek to destroy others. Supply chain businesses nowadays heavily focus on quality management in order to maintain and improve customer satisfaction, meaning that this business practice can be an application of the core concept of quality. The latter is especially important because while the
New Testament of the Bible instructs, “Loving thy neighbors” and to “turn the other cheek,” these teachings do not advocate being a doormat for oppressors to walk all over you (The Holy Bible, 1984).

Jesus in the New Testament had to violently overturn tables and drive away traders and moneychangers that were defiling the temple of His Father, which emphasizes a point that there is a line, and if it is crossed, then one must stand up with righteous anger (The Holy Bible, 1984). The teaching of “turning the other cheek” is not an action meant for the person receiving it, but for others; Jesus did not display the same level of righteous fury during His crucifixion as He did in the temple because He chose to die for everyone’s sins (The Holy Bible, 1984). In the real world, this kind of teaching must apply in tangent with what Keller and Alsdorf (2012) emphasized. The supply chain industry and security must remain stable through quality management and continuous improvement because the supply chain industry serves the people, whom God had created.

**Relationship to Field of Study**

The topic of this research was the need for enhanced supply chain security, which contributed to the field of Supply Chain Management and Logistics. The recent cyberattacks disrupting several crucial operations in the major ports of the West Coast have generated the need for improvement in supply chain security and measures to mitigate disruption risks and impact. Therefore, the research conducted for this study for the field of Supply Chain Management and Logistics would be a great contribution to the overall supply chain industry.

**Summary of the Significance of the Study**

By assessing the recent cyberattacks on major West Coast ports, information on how the attacks had occurred, what had been affected, and what measures were implemented to address
the security vulnerabilities would help further the research and to develop ideas that would help improve supply chain security. Risks like a complex cyberinfrastructure, under-trained employees, and non-flexible policies and procedures are contributing factors to disruptions of supply chain businesses. The purpose of this research was to evaluate these disruptions in the supply chain industry, learn from the past mistakes, and utilize the gathered information to develop potential solutions to improve supply chain security. Since the supply chain industry is crucial to the global economy and disruptions can cause setbacks in supply chain operations, improving supply chain security is just as important (Leonard et al., 2015).

A Review of the Professional and Academic Literature

Several literatures relevant to this research were presented to establish the existing data and past studies conducted on supply chain disruption and security. The main source of the literature came from Liberty University’s online library, and the articles and dissertation chosen for this literature review were peer-reviewed, for the purpose of credibility and validity, and published within the previous five years to ensure relevance. The literature searched for this section involved the agency theory, general systems theory, performance management, quality management, resilient supply chain, supply chain disruption, and supply chain security. Each topic contained an introduction of the concept, followed by the relevance to this research, then an extensive review of the literature that contributed to the concept.

The purpose of this literature review was to further enhance the research of the various methods of supply chain disruption and the impact they have on the supply chain industry. To continue the research on supply chain disruptions, the impact that disruptions have on the supply chain industry, and the methods to counter the disruptions, an extensive literature review was conducted on past studies and was compiled into this study. Each topic helped answer the
research questions, which focused on why supply chain security is lacking and how supply chain businesses implement measures to mitigate the risks to supply chain security.

*Agency Theory*

The agency theory is used by researchers to understand the relationship between the agents and principals in businesses for the purpose of mitigating risks in businesses caused by differences and misalignment of goals (Haloukas, 2019). In addition, Haloukas (2019) also addresses the contingency theory, used to explore the agency theory in further detail, to understand how situational factors specifically affect organizational behavior. In regard to supply chain security, the agency theory was used to analyze the relationship between the government and supply chain businesses, which represented the principal and agents respectively (Belzer & Swan, 2011). The use of both agency and contingency theories to analyze the relationship between the government and supply chain businesses correlated to the second research question, which focused on what kind of strategies the supply chain industry implements to reduce disruptions.

Haloukas (2019) also analyzed the relationship between the independent and dependent variables and how the relationship is affected by situational factors. For example, the independent variable concerns the different strategies implemented to avoid organizational problems while the dependent variable represents the degree to which problems are appropriately addressed by the strategies. The contingency theory was not used for the qualitative case study, but some of the information from Haloukas’s research regarding the contingency theory were used for a better understanding of the contributing factors to the vulnerabilities in supply chain security, such as the level of impact of different programs and plans to manage risks. Tangpong et al. (2019) applied the contingency theory as the main framework for behavioral research,
which is crucial to understanding how certain behaviors (e.g., personality traits, motivation, etc.) influence decisions that affect supply chain organizations. Behaviors within a supply chain organization also affect the relationship between the agents and principals and influence business decisions in the supply chain.

Belzer and Swan (2011) applied the agency theory to analyze the threats to the supply chain and opportunities for efficient solution. The main threat specifically analyzed in the article is human error because of technical hazards like weather, natural disaster, and equipment failure being uncontrollable, therefore being labeled background noise (although they can be planned around to minimize risk) (Belzer & Swan, 2011). Since the main focus of the agency theory is on the relationship between the agents and principals, the theory is most applicable to analyzing the threat of human error because the theory states that the principal hires an agent to act in the principal’s goals and interests. Therefore, the primary example of the threat to supply chain operations through the agency theory analysis was the conflict of interests between the principal and agent, whether the supply chain operation is foreign or domestic. The conflict of interest is especially prevalent in supply chain operations due to numerous businesses having different protocols and policies involved in a singular operation, such as a container cleared by Customs and Border Protection (CBP) officials becoming the responsibility of local organizations (Belzer & Swan, 2011).

Belzer and Swan (2011) addressed the cost of supply chain disruptions resulting from the risks created by the conflict of interests between principals and agents. The conflict of interests that contribute to supply chain disruptions impact the infrastructure and economy, the latter of which Belzer and Swan focused on the most by analyzing the long-term negative effects of financial decisions, such as keeping wages down. Keeping wages down creates less incentive for
good behavior by employees, and when combined with a supply chain business where physical monitoring is not as enforced as some supply chain businesses in the public or government sector, supply chain security becomes ineffective with glaring vulnerabilities.

Prosman et al. (2016) incorporate the agency theory into their research on behavioral-based governance methods (BBGMs), which is a wide range of buyer-initiated management methods (e.g. supplier certification, demand and information sharing, and supplier development) used to improve supplier performance. The agency theory is used to analyze and work around problems that arise in a relationship between the agent and principal in an agency (Prosman et al., 2016). The use of agency theory is particularly popular in the context of the supply chain because of the relevance in how supply chain businesses and operations are affected by the behavior of either the agent or principal, or both, such as the managers (principals) of reverse supply chain logistics in electronic waste designate employees (agents) to handle product collection, consolidation, and processing (Flygansvær et al., 2018). Prosman et al. (2016) stated that suppliers who act in their own self-interest create problems within an agency because of the conflict of interest between the agent and principal, which is similar to what Belzer and Swan (2011) observed. Prosman et al. (2016) specifically scrutinized the power imbalances between the agents (suppliers) and principals (buyers), which influence the effectiveness of BBGMs. BBGMs are found to be effective when suppliers do not act in their own self-interest but instead dedicate to their organization’s goals and vice versa. In some cases, BBGMs are effective even with acts of self-interest because the self-interest coincides with the organization’s goals (Prosman et al., 2016).

Shevchenko et al. (2020) focus on the prevention of supplier non-conformance, which is the supplier’s failure to conform to the requirements of the buyer. To accomplish the prevention
of supplier non-conformance, agency theory would support the monitoring of supplier behavior. The use of the agency theory in the analysis of the relationship between the principal and agent impacting the organization is implemented showing how the buyers (principals) can determine whether or not the suppliers (agents) need to be monitored. If the buyer faces major consequences resulting from supplier non-conformance (e.g. compromised product security), then the need for monitoring supplier behavior increases; on the other hand, if the buyer faces minor consequences because of supplier non-conformance (e.g. delayed shipment), then the buyer sources from trusted suppliers instead of monitoring supplier behavior (Shevchenko et al., 2020). The use of agency theory is most effective for Shevchenko et al.’s (2020) research because of the insight on the perspective on how buyers must respond to any threats in their supply chain. The agency theory is widely used by researchers to explain the behaviors of managers and employees in supply chain companies and understand what decisions must be made afterwards, such as the provision of necessary resources to build the desired supply chain skills (Dubey et al., 2018).

General Systems Theory

Dey (2016) had utilized the general systems theory as the conceptual framework for research because of its use in understanding the relationships between the individual parts of the supply chain and the external environment. The main idea of the general systems theory is that the system is effective when all the system’s aspects work together and is transformed by any changes. Since the environment can affect the system, boundaries that differentiate the internal and external environment need to be defined and implemented. Furthermore, time is the system’s crucial variable and feedback is the link between the system’s behavior and goal. With these concepts in mind, Dey (2016) was able to apply the general systems theory to understand how
inadequate managers in Ghana created disruptions through poor planning in managing global suppliers and subcontractors, in addition to external threats like natural disasters, political unrest, and poor economic conditions.

Additionally, the general systems theory allowed Dey (2016) to explore the perceptions of supply chain managers in order to conclude that supply chain performance can improve with mitigated disruptions through teamwork. Therefore, the general systems theory can be used in a similar manner in this research by exploring how the external environment can affect supply chain businesses. While the general systems theory explores relationships similar to the agency and contingency theories, the general systems theory focuses more on how factors outside of the work environment and organizational culture (e.g. global market demands) influence a supply chain organization. Understanding the relationship between supply chain businesses and the external environment could result in a better understanding of how supply chain businesses in need of enhanced security can develop and implement measures to accomplish more effective security. Beyond the global market demands, the external environment analyzed in this research included factors such as natural disasters and terrorists. Therefore, the external factors that contribute towards supply chain disruption could apply to this research in analyzing vulnerabilities in supply chain security and develop measures to account for these vulnerabilities and risks to prevent further disruptions. If preventing disruptions is not possible, then the risks and impact of damage can be mitigated with further preparations in both defense and recovery measures.

The general systems theory is also commonly used as a foundational theory based on the principles of general systems to understand systemic structure and behaviors in various fields (Rousseau, 2015). General systems theory is a systems model with the potential to improve any
system worldwide by implementing ethical practices, such as international cooperation and human dignity into a systemic structure. Implementing the general systems theory into a systemic practice facilitated scientific discoveries in areas lacking precise theories, support interdisciplinary communication and cooperation, and bridge the gap between objective and subjective disciplines to build a systemically healthy world (Rousseau, 2015). Dey’s (2016) application of the general systems theory to understand how the external environment affects supply chain businesses supports Rousseau’s statement on the positive effects of implementing the general systems theory to understand systematic structure. Therefore, Rousseau’s research in the general systems theory and the objective and subjective properties can help better understand how the systems in supply chain businesses can improve for enhanced security.

Chaudhry et al. (2019) analyzed the general systems theory in the context of human resource management. The general systems theory contains a combination of functions that are consistent and related to each other despite each function having specific behavior, boundaries, and structure. The relationship between functions is consistent with the previous establishment of the important concepts of the general systems theory, which includes the notion that the system is effective when all functions work together (Dey, 2016). In the context of human resource management, Chaudhry et al. (2019) found that a good human resource function collaborates with the managers of multiple departments to create a smooth flow of information and achieve the desired organizational goals. Katrakazas et al. (2020) conducted research to understand how the general systems theory plays an active role in the health care field and the benefits and consequences of the application of the theory. One example of a benefit in the hospital supply chain is that sharing information using cloud-based technology had positive results, such as inventory visibility, reduction in inventory levels, and customer service improvements.
(Katrakazas et al., 2020). Sharing information is a crucial aspect in a supply chain business when applying the general systems theory, as one of the main concepts is that the system is efficient when all functions work together (Dey, 2016).

**Lean Management**

Abdallah et al. (2019) explored how lean management positively impacts innovation performance with measures that emphasize adapting to changes. The difficulty of remaining competitive is continuously increasing because of the current market environment’s dynamic and rapidly fluctuating nature. Therefore, supply chain organizations have adjusted their policies and procedures to be more adaptive to the changes while remaining efficient. One method that supply chain businesses had utilized to adapt to the fluctuating market environment is by adopting lean management strategies. Japan’s industrial success was accomplished by lean management and has continued to be so because of its flexible design resulting in improved product variety and efficiency while reducing inventory levels and product defects (Abdallah et al., 2019). Lean management is also often sought after by supply chain businesses in need of an adaptive management style, especially when the matter of security is crucial. Both internal and external environments impact supply chain businesses, most of which can be very unpredictable and sudden, hence the need for lean management concerning supply chain security.

Alkhaldi and Abdallah (2019) examined the impact of lean management on health care. By measuring human resource management (HRM) and total quality management (TQM) of private hospitals’ operational performances, Alkhaldi and Abdallah (2019) found that there was no noticeable impact on efficiency despite the positive effect TQM has on quality performance. Therefore, TQM is not the quintessential strategy for cost reduction in private hospitals. Much like Abdallah et al.’s (2019) research, Alkhaldi and Abdallah (2019) applied the fundamental
principles and benefits of lean management to the health care industry to exhibit the effectiveness of lean management. Implementing lean management measures such as HRM and TQM is ideal for ensuring not only adaptive measures and procedures to the sudden changes in both the internal and external environment of organizations, but also mitigation of risks and impact of the sudden changes that result in disruptions. Security in the supply chain is ideal for mitigating risk of disruption caused by the external environment, but the internal environment has a different set of factors that lean management measures can account for. Both TQM and HRM correlate with measures that could ensure positive employee behavior, which in turn results in higher productivity and quality in addition to lower lead times, errors, waste, and inventory levels (Alkhalidi & Abdallah, 2019).

Po et al. (2019) utilized public hospitals for the research in the adoption of lean management. As lean management is a method that prioritizes adaptability to sudden changes, public hospitals are especially in need of measures that suit the lean management method. Lean management has gained traction in the healthcare industry because of the aspects that contribute to adapting to changes, such as continuous improvement, waste elimination, and employee empowerment. Additionally, most public hospitals have implemented other performance improvement initiatives that are utilized in conjunction with lean management that produces substantial positive results, such as benchmarking and performance measurement. Public hospitals are often limited in resources compared to private hospitals, but lean management has slowly become popular in adoption because of the method’s reliability in improving efficiency in almost all processes (Po et al., 2019). Supply chain businesses also benefit from adopting lean management because of the enhancements in efficiency accomplished by continuous improvement measures and waste elimination. In addition, employees are empowered by their
participation and contribution towards improving their organization’s processes via feedback, therefore creating further value in employees and providing motivation to maintain higher productivity. The aspects of lean management can also contribute towards enhancing supply chain security by continuously improving the efficiency of security measures while eliminating wastes in unnecessary procedures, which supply chain businesses need in the modern market environment where disruptions can happen at any time because of the occurrences of sudden changes.

Meng (2019) studied the use of lean management in construction supply chains and found four key elements of lean construction: focus on customer satisfaction, continuous improvement, learning and innovating, and waste mitigation, all of which coincide with previous studies on lean management. The purpose of lean management is to improve efficiency in all organizational processes and costs while ensuring adaptability to any unexpected changes. Therefore, lean management gained popularity worldwide and became one of the key tools to develop competitive advantage (Meng, 2019). In the context of the construction industry, lean management by itself is not effective because it causes difficulties in project delivery but is more successful when in a long-term collaboration with the supply chain industry. Meng (2019) conducted a study to find results of lean construction on three different levels of collaboration: none, short-term, and long-term. Each level in the order of lowest to highest collaboration resulted in a gradual increase in effectiveness, therefore proving that long-term supply chain collaboration is most preferable in lean construction. The results suggested that the four key elements in lean construction had more positive effects on cost performance, which means that the adoption of lean construction is crucial if cost has a higher priority over time and quality in construction projects. While lean management is beneficial in improving efficiency in time and
quality in products and services, lean management is more effective in improving cost performances. The effectiveness in cost performance improvement is the main appeal for many supply chain organizations to adopt lean management, especially because of the fast pace of the global market usually resulting in higher costs in operations.

Rundall et al. (2020) analyzed the relationship between lean management and hospital performance because of the complexities of implementing lean management in the health care industry. Despite the effectiveness of lean management since the origination of the management style in Toyota, the adoption of lean practices in hospitals showed that there is no universal method of lean management. Although past studies have shown that lean practices can improve cost and efficiency in processes, contemporary research claims that implementing lean practices in health care organizations is far more complicated than initially seen (Po et al., 2019; Rundall et al., 2020). Rundell et al. (2020) observed that the result of lean management in hospitals is highly dependent on factors pertaining to inconsistency, such as inconsistent leadership, cultural resistance, lack of resources, and other contextual factors. Past research estimated that less than five percent of lean adoptions are successful because of the contextual factors while success is common in organizations that are oriented towards employees, procedures, and market (Cadden et al., 2020). As such, supply chain businesses must understand how impactful the contextual factors are despite the decades of adoption of lean management. Contextual factors that conflict with organizational cultures that emphasize orientation towards employee and procedures is especially important to consider because of how the factors impact organizations, particularly supply chain businesses (Cadden et al., 2020).
Performance Measurement

Mangan et al. (2012) observed how performance measurement is one of many relevant and critical elements in supply chain management (SCM) and global logistics. Performance measurement is driven by the increased reliance on contract manufacturers, third party logistic providers (3PLs), competition, impact on customer relationship, information technology innovations, and employee motivation. Employee motivation is especially important in this research based on the previous statements about productivity and employee motivation being a major contributing factor to a supply chain business’s success. Supply chain organizations have various methods to reward employees for hard work and maintaining positive performance, such as promotions, public recognition for best performance, or communicating the metrics of performance standards to all employees (Mangan et al., 2012). Performance measurement is an integral aspect of SCM because of its emphasis on improving the performance of the organization, specifically through the employees of all levels. Therefore, performance measurement was important to account for employee performance as a factor in supply chain disruption caused by low productivity.

Laihonen and Pekkola (2016) also supported the notion that performance measurement systems influence and impact SCM by assessing the consequences of the behavior of employees and the capabilities and performance of an organization. Laihonen and Pekkola discussed the three different perspectives of SCM (i.e. management philosophy, implementation of the philosophy, and set of management processes) because of the scarce number of studies and evidence on exactly how impactful performance measurement is on SCM. Performance measurement is a management intervention, which affects people’s behavior and the supply chain organization’s capabilities and performance. Furthermore, Laihonen and Pekkola
emphasized the importance of transferring and sharing the information obtained from the performance measurement among the employees to create a basis for shared discussion and the understanding of objectives, status of operations, and methods of development.

Vlachos et al. (2020) also supported the concept of knowledge sharing in the context of lean management as an effective means for proper implementation and improving organizational culture, productivity, and operational efficiency. The distribution of performance measurement information encourages collaboration and teamwork through constructive criticism and improving from what is stated among the criticisms, which in turn improves productivity in employees. Laihonen and Pekkola’s (2016) research into performance measurement as a method of improving employee productivity and the operations of supply chain businesses is ideal for this research in understanding the factors that contribute to positive employee productivity to mitigate the risks of supply chain disruptions.

Saunila (2016) incorporated performance measurement to improve innovation capabilities in small and medium-sized enterprises because of the importance of innovation in the survival of modern businesses. Innovation capability is considered one of the most important criteria to enable businesses to achieve high levels of competitiveness in both the national and global market. Improving a business’s innovation capability is accomplished with performance measurement systems, which is a comprehensive process involving the performances of all operations within an organization. Some examples of performances include leadership and management, employees’ motivation and willingness to work, the quality of operations, and the capability of products to fulfill customers’ needs. Saunila (2016) drew similar conclusions to the previous literature on the effectiveness of performance measurement systems on employees’ motivation and productivity, summarizing that the proper use of performance measurements can
better develop innovation capabilities. The proper measures must be dynamic and adaptive, much like the concept of lean management, and must also be continually reviewed and developed, which is the core concept of performance measurement (Saunilla, 2016). Therefore, Saunila’s research could contribute to this research by supporting the notion that performance measurements of employees’ behavior and motivation and an organization’s operations are crucial to addressing the risks of supply chain disruption via internal factors.

Maestrini et al. (2017) support the notion that performance measurement of a large spectrum of tasks (e.g. logistics, inventory management, and demand forecasting) is crucial to achieving improvement in supply chain performances. Supplier and customer relationship management is also mentioned as an important task that requires performance measurement, which coincides with the basic concept of the agency theory (Maestrini et al., 2017). Maestrini et al. (2017) emphasized the definition of supply chain performance measurement systems (SCPMSs) to highlight the recent adoption of the system because of new technologies allowing for collecting, integrating, and sharing information between multiple supply chain businesses. The sharing of information as a requirement in supply chain businesses is consistent with what was established for both performance measurement and lean management. Furthermore, performance measurement is not a system adopted within a single company’s boundaries as earlier performance measurement research had assumed, but is a system that spans across multiple supply chain businesses with different processes, functions, culture, units, and metrics. The wider scope required for studying performance measurement is a factor that researchers must consider when conducting research on the field of supply chain, especially when the research is focused on enhancing security in supply chain businesses.
Bourne et al. (2018) stated that performance measurement plays a critical role in any organization’s operations because of the enhancement in communication within an organization. The communication mainly entailed the critical question to be addressed for the sake of improving an organization, which is how performance is going to be defined. However, a great deal of confusion and conflict resulted from attempting to answer the question, which is the result of the lack of a universal solution. While Bourne et al. (2018) conducted their research to better understand performance measurement, a wider scope is needed to properly conduct the research because of the numerous varieties in scenarios and factors involved (Cadden et al., 2020; Maestrini et al., 2017). However, the wider scope recommended by Bourne et al. (2018) and other researchers may be impossible to incorporate because of the necessary delimitations needed to ensure focus on the scope of the research, which is the enhancement of supply chain security. Bourne et al. (2018) stated that performance measurement has a wide scope with numerous processes and factors (e.g., dynamics of people and teams, interactions between department, and relationships between parent and child companies). However, some studies (Bondwe, 2019; Haloukas, 2019) deliberately limit the scope of research to analyze in detail the effects of different practices on supply chain organizations, which means that unaccounted contextual factors that impact other organizations differently remain (Cadden et al., 2020).

Ravelomanantsoa et al. (2020) conducted research on performance measurement systems to develop a system widely applicable to all types of approaches and methods of performance measurement. Methods for performance measurement systems, such as the famous balanced scorecard, were developed to measure an organization’s performance and improve where improvements are needed. The balanced scorecard system was a system initially designed for measuring financial performance since its creation in the late 1990s but had evolved in
subsequent adoptions by incorporating other crucial perspectives: customer, internal business processes, and organizational learning and growth (Meredith & Shafer, 2019). Additionally, Ravelomanantsoa et al. (2020) suggested comparing approaches when developing a performance measurement system, which is almost the same as benchmarking. Collaboration between supply chain organizations is crucial in improving efficiency in all processes and operations while maintaining competitive advantage (Meng, 2019). While several different performance measurement systems can be developed and implemented, the important caveat to understand is that each approach can be improved based on the qualities found in other performance measurement approaches (Ravelomanantsoa et al., 2020). Therefore, supply chain businesses must consider the number of different methods that performance measurement systems are developed and implemented based on the different processes and business cultures of each supply chain organization.

Kamble and Gunasekaran (2019) attested to the importance of performance measurement when managing diverse supply chains. Different supply chain businesses have different organizational cultures that influence diversity as a constant factor for consideration. Since diversity exists, then a variety of different processes and procedures will also exist, hence a performance measurement system is required to quantify the efficiency and effectiveness of business actions (Kamble & Gunasekaran, 2019). In addition, performance measurement facilitates further open communication and transparency between stakeholders of a supply chain organization, thus creating a supportive work environment and improving organizational performance. Information gathered from performance measurement of supply chain organizations must be timely and efficient to facilitate strategy formulation, implementation, and monitoring. Kamble and Gunasekaran (2019) also mentioned the balanced scorecard approach as
an example of performance measurement to measure both financial and non-financial aspects to achieve strategic alignment. The balanced scorecard is a common example of performance measurement because the system provides a wider perspective of what must be measured within an organization, which provides managers a better environment for decision-making and implementing the decisions. Therefore, balanced scorecards and other performance measurement systems are more effective for supply chain businesses when analyzing tangible and non-tangible assets.

**Quality Management**

Plenert (2012) defined quality as the meeting of customer expectations through a three-step process: quality planning, control, and improvement. Therefore, in order to implement quality, the organization must identify customer needs and establish a continuous improvement process for product goals. Quality control is the systems tools implemented to inform supply chain employees of their organization’s quality goals, which allows the employees to adjust their activities to achieve the quality goals. Therefore, quality control is a continuous improvement process that supply chain businesses must incorporate into other continuous improvement practices, such as lean management.

Plenert (2012) stated that the quality improvement process must be incremental rather than an enterprise-wide breakthrough in order for supply chain organizations to remain competitive. Quality management plans with a continuous improvement focus must meet the basic requirements, which include customer satisfaction, waste reduction, and continuous improvement (Muthukumar, 2013). Since customers often demand quality in products and services, supply chain businesses must ensure to involve continuous quality improvement in
quality management, especially when considering the current market environment where demand fluctuates and feedback on the provided quality spreads worldwide very easily.

Benavides-Chicón and Ortega (2014) supported the notion that continuous improvement processes are integral to quality management. By applying the hospitality sector (specifically with hotels) to determine the relationship between quality management and productivity, they found productivity to be influenced by employee training and motivation. Benavides-Chicón and Ortega (2014) indicated that hotel managers may have little awareness of the importance of factors like staff motivation and ongoing training. Furthermore, managers must be aware of the importance of contributing factors to productivity via employee behavior before understanding and implementing measures that encourage positive behaviors. Productivity in supply chain businesses cannot improve without understanding the contributing factors.

Putri et al. (2017) analyzed the influences of total quality management (TQM) implementation on employees’ productivity through the predominant factors that positively affect employees’ productivity. The predominant factors needed to establish a successful implementation of TQM included human resources, standards, and training and education. The result was that the predominant factors not only have positive effects on employees’ productivity, but also on a TQM program’s success. However, achieving the positive effects would also require a high level in employees’ willingness to work and contribute to their organization. Having a high level of employee dedication results in higher productivity, which ensures quality in products and procedures. High-quality procedures also mitigate risks and vulnerabilities in supply chain operations, which can be applicable to this research concerning enhancing supply chain security.
Fernandes et al. (2017) discussed the integration of quality management in SCM because of the emphasis on quality by both businesses and customers. Customers frequently seek quality in products and services rendering it a key competitive factor globally. Therefore, quality management promotes the competitiveness between organizations in order to meet or exceed the customer demand and needs in products and services (Fernandes et al., 2017). Quality management is an essential strategic management tool incorporated in many businesses, particularly in the supply chain industry. Since quality is one of the main customer demands, quality management must also involve continuous improvement. Continuously improving processes and procedures in supply chain operations is crucial in ensuring the best services are always provided to the customers, as well as mitigating any risks to supply chain disruptions (Haloukas, 2019). The fast-paced market environment driven by the fluctuating customer demand is the major factor in the severe losses that supply chain businesses suffer, as disruptions in the supply chain also means a halt in the provision of services and products, which results in the customers promptly turning to a different competitor to obtain the desired services. Therefore, supply chain businesses must incorporate quality in security measures for both internal and external risks, as any disruptions in the supply chain could very easily result in major losses (Duong et al., 2020).

Bastas and Liyanage (2018) conducted research on quality management that is sustainable because of the few studies on the topic and the growing importance of maintaining profitability while optimizing business operations environmentally and socially. Customers’ demand in recent years required supply chain organizations to have quality performance environmentally, socially, and financially in products, processes, and services. Therefore, sustainability management has become required in supply chain businesses to remain
competitive while satisfying present and future customer demand. Bastas and Liyanage (2018) also emphasized the importance of organizational performance concerning the implementation of sustainability management, meaning that several quality management practices must be maintained at a high performing level, such as continuous improvement and leadership. de Menezes and Escrig (2019) highlighted the need for continuous improvement initiatives as part of performance management, such as monitoring employee performance to improve productivity and quality. The continuous improvement initiatives coincide with previous literatures on performance measurement and quality management that modern supply chain businesses usually implement to maintain competitive advantage.

Wei et al. (2019) asserted that quality management is only possible when performance measurement systems are involved. Performance measurement systems must be redesigned to be more innovative and completely emphasizing the goals between employees and the organization. Innovative performance measurement systems must also incorporate consideration of financial and non-financial indicators, much like the requirements for balanced scorecards. Additionally, employee consideration must also be incorporated to ensure the motivation and commitment factors that are necessary for quality management, which coincides with the employee empowerment benefit of lean management (Po et al., 2019). Quality management includes multiple dimensions that businesses must implement at high levels to achieve quality, which includes management leadership, training, employee relations, quality data and reporting, and process management (Wei et al., 2019).

The employee dimension is especially important because each employee needs to acquire the competencies that are relevant to quality management by receiving the necessary training to develop the skills and knowledge to accomplish the tasks and solve the problems encountered in
the implementation of quality management. Additionally, if the employees are given the
necessary training to develop their skills and knowledge, then the employees also have the
capabilities to identify employee-related factors that are necessary for implementing quality
management, such as employee participation (Wei et al., 2019). Therefore, supply chain
businesses must incorporate employee consideration and empowerment when implementing
quality management, as providing employees with further knowledge and skills obtained from
training can reduce risks of disruptions and improve the quality of responding to supply chain
disruptions.

Resilient Supply Chain

Elluru et al. (2019) stated that a resilient design is important in SCM because of its
capabilities to conform to the rapid changes in demand within the market environment. By
presenting the resilient design that accounts for both manufactured and natural disasters, these
authors acknowledged the trend that supply chain businesses focus on designing operations
systems that are resilient to man-made and natural disasters to achieve the customer satisfaction
that drives the market demand. Furthermore, they claimed that both proactive and reactive
approaches focus on the two major decisions responsible for the supply chain distribution
network: facility location and vehicle routing. The proactive approach focuses on eliminating
disruption costs in the event of disasters for both facility and route disruption scenarios while the
reactive approach focuses on penalty costs optimization when the facility expansion and routing
cost is higher in the event of a disruption (Ellura et al., 2019). The two different approaches are
both implemented as a measure to adapt to sudden changes in both the internal and external
environment that result in disruptions, which coincides with lean management. Resilient supply
chain design is practically a form of lean management, in which the latter focuses on quality and
human resource management while the former focuses on the structure of an organization’s systems and policies. The approaches proposed by Ellura et al. (2019) can provide insight into designing a resilient supply chain system that accounts for manufactured and natural disasters.

Siegel (2018) also emphasized the importance of a resilient design in SCM because of its capabilities in conforming to the demands caused by the rapid changes in the market environment. Supply chain organizations would and should be more dedicated to identifying and addressing anticipated and unanticipated risks by implementing a proactive and enterprise-wide resilient design with a multidisciplinary risk management method in business. Siegel (2018) cited the Pathfinder-SMS in Pakistan as an example of a resilient and proactive measure designed to identify and address risks with an enterprise-wide implementation. The measure’s implementation was large enough to change the organization’s entire culture but was also effective in improving organizational performances and customer satisfaction. Siegel (2018) attributed the result to the effective organizational leadership engaging in the system’s design and employee empowerment contributing towards risk management. The result of Pathfinder’s design is a testament to supply chain organization needing resiliency because the risks and vulnerabilities resulting in supply chain disruption mainly originate from the inability to adapt to or recover from disruptions. Resilient design in the supply chain is capable of not only accounting for internal risks, but also external, therefore serving as a potential measure to enhance supply chain security.

Manhart (2017) focused on supply chain resilience as an important aspect of a supply chain organization’s design. In addition to supply chain disruptions being severely impactful to supply chain businesses, the external environment of the supply chain industry is changing and progressing at a fast rate, therefore increasing the need for resilience. Resilience is described as
the ability to recover after a supply chain disruption, which is mainly accomplished by learning from disruptions and disseminating the knowledge throughout the entire organization (Manhart, 2017). However, disruptions are difficult to learn from due to lacking identical traits, such as differing sources, severity, and duration. Without being able to learn properly from disruptions, supply chain organizations would have difficulties in incorporating resilient capabilities (Manhart, 2017).

Ruiz-Benitez et al. (2019) further support the notion that supply chain businesses nowadays are concerned with the economic, environmental, and social impact of their operations, hence the need for sustainability via lean and resilient supply chain practices. Resilient practices in supply chain businesses are considered ideal because of the capability in overcoming unexpected events. An additional caveat to keep in mind is differentiating lean and resilient practices. Though both practices focus on adapting to sudden changes, lean management has more orientation towards waste management while resilient practices focus more on the entire process itself (Ruiz-Benitez et al., 2019).

Kaur and Singh (2019) incorporated the modern issue of environmental disaster and rapid climate change to emphasize the need for resilient designs in supply chain businesses. Environmental issues and natural disasters are some of many types of rapid changes that can severely impact supply chain businesses, especially when a business is woefully unprepared to deal with the abrupt disruption and suffer consequently. Sustainable supply chains are desired by many supply chain organizations, and Kaur and Singh (2019) stated that designing resiliency against environmental factors is crucial to accomplishing sustainability. A study by Rezapour et al. (2017) supports the notion that resiliency against environmental changes is ideal by incorporating an example of two different motor companies in Japan that dealt with the 2011
earthquake differently, in which Nissan Motor Company Ltd recovered faster because of a resilient design. Kaur and Singh (2019) proposed a model for sustainable procurement and logistics that stressed minimizing carbon emission as part of a disaster resilient supply chain design. An optimal trade-off between increasing logistics operations and reducing carbon emissions must be addressed when developing a resilient supply chain and environmental sustainability. A supply chain business must consider the trade-off successful in mitigating disruptions in case of disastrous events.

Jabbarzadeh et al. (2018) also attested to the need for resilient designs in supply chain businesses that is sustainable. Many supply chain businesses made significant progress in process improvements through trends and strategies such as global outsourcing, supply base rationalization, just-in-time deliveries, and lean practices. However, supply chain firms, especially global ones, are more vulnerable to disruptions caused by natural disasters, terrorist activities, unexpected regulatory issues, global customs, foreign regulations, and political and economic instability in the foreign country. Other research (Sawyerr & Harrison, 2019) has acknowledged how increased globalization and outsourcing creates a more dynamic market but with increasingly vulnerable supply chains. Jabbarzadeh et al. (2018) listed the two types of risks that supply chain networks are vulnerable to: operational risks (high-probability-low-impact) and disruption risks (low-probability-high-impact). They developed and presented a model that determines controlled outsourcing decisions and resilience strategies that minimized expected total costs and maximized overall sustainability performance in disruptions. Supply chain businesses seek cost efficiency and sustainable resiliency as methods for security against any vulnerability, especially considering the increased frequency of disasters and disruptions (Sawyerr & Harrison, 2019).
Supply Chain Disruption

Park et al. (2016) stated that supply chain disruptions result in declining sales, cost increases, and service failures for supply chain businesses, hence the need for business initiatives that incorporate resiliency against risks and uncertainties. Disruptions can range from factors such as natural disasters to terrorist attacks, all of which must be planned around by supply chain businesses to avoid the negative impact of either occurrence (Park et al., 2016). Regardless of the probability of occurrence, disruptions of any level caused by various reasons must be accounted for to prevent complacency and mitigate risks that would subsequently result in damage to business performances, especially after the terrorist attack on September 11, 2001.

Khan et al. (2018) also emphasize the terrorism aspect as a major risk to the global supply chains. Similar to the problems of cyberinfrastructure, the size, scope, and complexity of the global supply chain infrastructure had increased the vulnerabilities to disruptions. Because of the increased risk of supply chain disruptions, especially by the hands of terrorists, terrorism is a major consideration in risk management and supply chain sustainability. Since sustainability is involved, terrorism incorporated into risk management must also be a consideration when it comes to lean and resilient practices in supply chain businesses. Even attacks with minimal damage can set back supply chain businesses because every operation within an organization is crucial for business operations.

Forte et al. (2016) emphasized how improvements in the cyberinfrastructure of the supply chain had increased the complexity of the entire system. The increase in complexities subsequently resulted in an increase in susceptibility to bugs, faults, and vulnerabilities, all of which could result in economic and life-threatening consequences (Forte et al., 2016). Where Park et al. (2016) and Khan et al. (2018) discuss external factors like terrorism being a major risk
in supply chain disruptions, the cyberinfrastructure serves as a major internal risk that can easily be susceptible to human error. Kenny (2017) also attested that the developments in technological innovations created numerous vulnerabilities that are easily exploited, but unfortunately, there is very little that can be done about it. The main reason Kenny (2017) stated that little can be done to solve the problem is because the problem is also a cultural issue since practically the entire world became deep-rooted in technology. Therefore, Forte et al. (2016) focused on raising awareness of the vulnerabilities created by the complexities of cyberinfrastructure and the difficulties of managing the system for the global supply chain, particularly by independent and potentially untrustworthy parties.

Bier et al. (2019) also acknowledged the difficulty of incorporating risk management to mitigate the effects of supply chain disruptions because of the increasing complexities of supply chains. Improvements in processes and technologies have gone a long way to increasing speed and efficiency in supply chain operations, but the improvements have also increased the complexities of supply chain systems, which also increased the risk of disruptions. Supply chain disruptions pose a significant threat to businesses, which can result in cost increases, profit losses, and damage to the company’s reputation (Bier et al., 2019). Catastrophic events are low-probability-high-impact risks that must be addressed but not prioritized over high-probability-low-impact risks. The risks with high probability occur from fluctuations in regular operations, which are often caused by human error and thus are more frequent. Therefore, supply chain businesses must incorporate a culture and process that emphasizes continuous improvement to address the frequent risks that contribute towards supply chain disruptions.

Revilla and Saenz (2017) emphasized the need for supply chain risk management, considering the increased risks of disruptions to vulnerable supply chain businesses because of
the dynamic and complex evolution of markets. Supply chain disruptions have various levels of negative impact, such as physical and sales damage, reduced company revenue, costs inflation, and damaged value of the company and shareholders. Furthermore, not only does supply chain disruptions negatively affect supply chain businesses, but also the customers, as many customers require the products and services provided by supply chain businesses for their livelihood. Revilla and Saenz (2017) developed a model analyzing four different patterns of how supply chain companies manage supply chain risks internally and externally: passive, internal, collaborative, and integral. Passive companies spend less time and resources on risk management, internal companies only focus on internal processes and not external, collaborative companies prioritize the external network but not internal processes, and integral companies concentrate on risk management on all levels. Ideally, supply chain businesses must strive to be integral companies, but some measures may be costly and counterproductive, which is what businesses must avoid. Supply chain managers face a great challenge in combining both supply chain management and risk management to prevent disruptions because different companies require different combination of strengthening internal processes, aligning with suppliers and customers, and implementing the required activities into operation (Revilla & Saenz, 2017).

Duong and Chong (2020) attested that collaboration is important in reducing supply chain disruptions, which coincides with information sharing as part of supply chain collaboration (Dey, 2016; Katrakazas et al., 2020; Maestrini et al., 2017; Vlachos et al., 2020). Dealing with supply chain disruptions is a large burden for a single supply chain organization to deal with alone because of the global market’s unpredictability creating lean and flexible supply chains. As established previously, sharing information between supply chains improves inventory management, customer satisfaction, and employee performance (Katrakazas et al., 2020).
Information sharing performance measurement data allowed for shared discussion within and beyond a supply chain organization about improving business and operations, which makes collaboration just as crucial in the context of mitigating supply chain disruptions (Laihonen & Pekkola, 2016). While Jabbarzadeh et al. (2018) stated that outsourcing increases the risk of supply chain disruptions, collaboration allows for multiple supply chain businesses to thoroughly analyze and benchmark practices that are effective or ineffective and develop their own processes to improve efficiency in costs and operations. The accuracy, relevance, and timeliness of the information shared between supply chain businesses are necessary for situational awareness and planning for disruption responses.

Akkermans and van Wassenhove (2018) described supply chain tsunamis as recurring major strategic supply chain phenomenon that severely afflicts the entire supply chain industry. An example of a supply chain tsunami is the massive and sudden downturn of a high-tech electronics industry in 2001 had sent many companies to near bankruptcy. The ongoing COVID-19 pandemic is the modern example of a supply chain tsunami because of the large number of businesses halting or filing for bankruptcy, but many opportunistic retail giants like Amazon managed to take advantage of social distancing by creating more online activities to overcome supply chain disruptions and continue its operations. Supply chain tsunamis are another example of low-probability-high-impact risks because of the low frequency of supply chain tsunamis but extreme impact they cause on the supply chain industry. The effects that supply chain tsunamis have on the supply chain industry are a major reason for supply chain businesses to develop and implement measures and practices that can mitigate the risks or damage.
Supply Chain Security

Christopher (2015) discussed the importance of security at U.S. ports as a result of the growth that the maritime industry has seen since the 1950s. Maritime transportation has become an integral part of the U.S. and global economy and a very efficient system that is able to keep pace with the fluctuating and rising demands. Therefore, ports have become an important asset to protect from disruptions and to ultimately protect and preserve the domestic and global economy. Christopher’s (2015) research focused on the physical security vulnerabilities and threats, such as hazardous material, piracy, thefts, terrorism, and risk management. The findings support recommendations that port security is a necessity that needs to be updated on a frequent basis while remaining cost efficient in regard to the inconsistent yet consistently rising market demands. However, Christopher (2015) did not focus much on the internal threats to supply chain businesses, such as human error and lack of proper safety standards and protocols, both of which are extremely detrimental to port operations and result in further losses and delays. Supply chain businesses must account for both internal and external threats to supply chain operations. While terrorism is a growing threat in the modern global market, many disruptions also occur from internal threats, such as human error and theft.

Adams (2018) focused on the importance of the government’s role in security measures and the awareness of the impact of security measures on productivity in supply chain businesses. The prospect of supply chain disruptions caused by factors like weather and terrorism in the current fast-paced global market is a primary motivating factor in investing in improving supply chain security. Adams also stated that implementing security measures must consider various aspects to secure in addition to the physical aspect, such as ensuring procedures to record and verify cargo transfer, scrutinizing employee activities, and overseeing information systems.
Supply chain security measures have positive impact on the productivity of supply chain businesses because of the operations having capabilities to continue at an optimal level immediately, which is accomplished by a combined investment by the government and supply chain organizations.

Leonard et al. (2015) described the history of the maritime industry, its growth since the introduction of containerization in 1956, and the increasing need for port security. By establishing that this growth had made maritime transportation so important to the U.S. and world’s economy, they argued for improved security at all ports given their vulnerability to terrorist and criminal attack. Since the terrorist attack on 9/11, supply chain security has become a mounting necessity, which is further supported by Belzer and Swan’s (2011) observation that attempts to disrupt the supply chain do not necessarily need to be successful. The attack alone is enough to scare businesses into improving security measures to limit the risk of another attack, which can be costly, and the additional burden by the need for security can weigh down the industries involved. Enhancing security is associated with improving processes because of the variations in which supply chain operations can be attacked and disrupted and the levels of damage can vary but will still result in losses that need to be recovered. Supply chain businesses must ensure to account for attacks, particularly in technology, concerning security and resilient supply chain design despite the low probability of occurrence. Without high quality security measures, supply chain businesses would never improve financially and economically.

Lu et al. (2018) emphasized the importance of supply chain security by citing several examples of cargo theft that occurred in the past, which resulted in the loss of several millions or billions of U.S. currency. However, Lu et al. (2018) stressed that businesses deploy different supply chain security practices, each having varying degrees of potential to have adverse effects
instead of beneficial outcomes. Some businesses may employ practices that prefer to satisfy governmental and customer programs, even if the practices may be costly in terms of finance, customer delivery lead time, and delivery reliability (Lu et al., 2018). More disadvantageous than beneficial security practices may result in further scrutiny, which unnecessarily wastes time and resources. Furthermore, implementing the right security practices to mitigate supply chain disruptions is heavily dependent on top management involvement and capability (Lu et al., 2018). Lu and Koufteros (2019) further classified different supply chain security practices into four categories: prevention, detection, response, and mitigation. Both studies emphasized how supply chain managers should apply the data and information for the planning and execution of security practices. Each category has different characteristics and implications that can apply in one or multiple scenarios, but all must be fast yet efficient to properly prevent or mitigate the effects of supply chain disruption (Lu & Koufteros, 2019).

Yeboah-Ofori and Islam (2019) addressed the need for cybersecurity because the supply chain industry is embracing it as a strategy to improve business processes, increase production speed, and reduce distribution costs. Some cyberattacks resulted in the manipulation of design specifications, alteration, and manipulation during distribution, which causes supply chain disruptions. Just as Forte et al. (2016) discussed the complexities of cyberinfrastructure as a major contributory factor to supply chain disruptions, Yeboah-Ofori and Islam (2019) reviewed the situation and proposed a model to address the need for security in technological systems. These authors proposed an attack model designed for identifying and counterattacking future cyberattacks based on pattern of behaviors observed through sets of incidents across an organization’s supply chain. Supply chain companies need to invest in a cybersecurity system that can protect the company’s entire system with a continuous improvement process since
attackers can develop newer methods and systems to attack before an organization becomes aware of the attack.

Summary of the Literature Review

The articles and scholarly sources reviewed in the literature review was meant to focus on providing background information leading up to the increasing need for enhanced supply chain security. Theories such as the agency and general systems theories were incorporated to better understand the internal and external factors that contribute to supply chain disruptions while other concepts of SCM were explored to understand potential solutions to mitigate risks of supply chain disruptions. The concepts explored through various literature and scholarly articles included lean management, performance measurement, quality management, resilient supply chain disruption, and supply chain security.

The concepts explored in this literature review were incorporated because of their potential as solutions to both enhance supply chain security and mitigate supply chain disruptions. Supply chain disruptions are often the result of both internal (e.g. low productivity, poor quality of products and operations, and inadequate organizational performances) and external factors (e.g. natural disasters, changes in the global market demand, and terrorist attacks) (Adams, 2018). The increase in the global market demand had not only sped up the pace of the supply chain operations but had also increased the negative impact of supply chain disruptions. Customer satisfaction is integral to every supply chain organization, which is why many policies, procedures, and operations are centered on prioritizing customer satisfaction. Disruptions that occur in the supply chain for either internal or external reasons would result in low customer satisfaction, which could be devastating to supply chain businesses both financially and economically.
The devastation caused to supply chain businesses because of disruptions had also increased the appeal for terrorists and criminals to contribute towards the disruptions (Khan et al., 2018). By disrupting supply chain operations, not only is the afflicted supply chain business impacted, but the economy is also negatively impacted, which then affects both supply chain businesses and customers (Leonard et al., 2015). Recent examples of supply chain disruptions, particularly in the maritime industry, are testaments to how even small levels of supply chain disruptions result in major financial losses that threaten the U.S. and global economy (Christopher, 2015). Therefore, this research focuses on understanding how supply chain disruptions occur and is addressed through risk mitigation measures sought after by supply chain businesses.

The market demand is extremely fast-paced and constantly fluctuates, hence the need for measures that can adapt to the dynamic nature of the global market (Abdallah et al., 2019). Therefore, lean management and resilient supply chain design are considered because of the capabilities in adaptability in both measures. Although both practices are ideal in adapting to any rapid developments that could result in supply chain disruptions, lean management is ideal for increasing efficiency and decreasing waste and defects while resiliency is ideal as a recovery plan in the event a major disruption occurs, thus requiring supply chain businesses to bounce back and continue operations.

In addition to implementing adaptive practices and measures like lean management and resiliency, other measures must be incorporated to ensure that supply chain businesses are adequately equipped and prepared to implement the measures. Quality management is the general method that many supply chain organizations incorporate because of the importance of customer satisfaction (Muthukumar, 2013). High quality in both organizational processes and
products could fulfill customer satisfaction, which is the integral driving force behind the market demand on both national and international levels. Furthermore, performance measurement is an idyllic method to ensuring that employees and organizational operations are performing at a satisfactory level or higher. Conducting performance measurements is necessary as a continuous process because of the rapid changes in the market environment creating new standards at a fast pace.

While ensuring high quality and constantly being monitored by performance measurements may seem like heavy burdens for employees to carry, employees can be positively motivated to be dedicated to their work, thus ensuring higher productivity. Methods such as implementing ongoing training and ensuring strong communication to employees of the performance metrics could motivate employees to consistently work their hardest for their organization (Benavides-Chicón & Ortega, 2014). Combining quality management with performance measurement guarantees high productivity, which can be implemented alongside lean management and resilient designs to create an organizational environment that is ready to adapt to sudden changes that could easily disrupt operations and negatively impact business and the economy. Implementing lean measures and resilient design also allows supply chain businesses to focus on addressing vulnerabilities that, if exploited, could result in supply chain disruptions. Additionally, addressing vulnerabilities resulting in risk of disruptions, sometimes through collaboration with other supply chain firms, is the initial step in implementing measures that could enhance supply chain security, which is the focus of this literature review.

Transition and Summary of Section 1

Section 1 introduced the background of the study and problem, problem and purpose statements, nature of the study, research questions, description of the conceptual framework,
definition of key terms, assumptions, limitations, delimitations, significance of the study, and literature review. The purpose of Section 1 was to provide the basic information to inform the readers and future researchers about what has been established concerning the supply chain industry and need for supply chain security enhancements. With Section 1 established, the groundwork is formed to transition into Section 2, which focuses on the research method and data collection.
Purpose Statement

The purpose of this qualitative case study is to understand the various ways the supply chain industry incurs disruption from the lack of enhanced security and the development of potential ideas on how disruptions receive mitigation. The shipping ports in the western region of the United States have seen several cyberattacks in recent years, which resulted in disruptions that have negatively impacted supply chain businesses and their customers. As such, these ports served as a catalyst in this study to understand why the supply chain industry is in dire need of measures to mitigate supply chain disruption risks and impact. Furthermore, the cyberinfrastructure that resulted from the vast developments and innovations of information technology has created numerous vulnerabilities alongside the efficiencies, resulting in the need to address technology as a major factor in enhancing supply chain security (Forte et al., 2016). The result of this study could provide insight to the issue of the vulnerabilities in supply chain security and develop potential ideas for more efficient supply chain security practices, which could result in higher long-term productivity (Adams, 2018).

Role of the Researcher

Haloukas (2019) stated that the role of the researcher is important throughout the entire research process, which includes the design of the study, conducting of the interviews, coding, analysis, and verifying and reporting the concepts and themes. As such, the researcher is the primary instrument for data collection, which is accomplished through various methods, such as a questionnaire (Bondwe, 2019). The primary method of collecting data was through questionnaires before analyzing, compiling, and presenting the data in the research.
Additionally, ethical guidelines must be adhered to ensure that participants of the research are protected by way of anonymity and confidentiality (Petrova et al., 2016). The researcher must ensure that the names of the participants of the research remain anonymous and that the information and data provided by the participants are used appropriately without detriment to them (Bondwe, 2019). As such, the data collection was obtained from interviews to guarantee both in-depth conversations needed for a thorough case study and safety for the participants not only in confidentiality but also in consideration of the COVID-19 pandemic. Providing questionnaires before the interview is also ideal for allowing participants to think about their answers and articulating them with details that can greatly contribute to providing objective information about the current state of the participants’ organization.

Finally, the researcher must also take measures to prevent or mitigate personal bias as much as possible. The participants recruited for the data collection process in the research should not have any personal connections with the researcher, as personal connections result in personal biases (Haloukas, 2019). Furthermore, the researcher must ensure that the questions for the questionnaire are worded in a way for the participants to properly understand and provide well-informed answers with different perspectives (Bondwe, 2019). The modeling of questions to avoid bias also coincides with the mitigation of researcher bias, which is accomplished by bracketing. Bracketing is the disregard of the prior knowledge retained by the researcher at the start of a research or study, which allows factors like personal beliefs, values, experience, and knowledge to not influence the research (Wadams & Park, 2018).

Participants

The participants in the group included high-level employees of supply chain organizations of various locations. The first-hand accounts were obtained from the participants
who were high-level employees of supply chain organizations. Participants represented a mixed hierarchy, from the low-ranking employees to the executive management. The first-hand accounts of the different levels of employees offset the main setback of qualitative research methods, which is inductive reasoning being the primary tone (Haloukas, 2019). The primary data reflected diverse and multiple perspectives and ensured validity and reliability.

As stated previously, the only method of contact and collecting data was through email and voice chat interview in consideration of the participants’ safety. Furthermore, contacting the participants by way of email provided more flexibility in everyone’s schedules, as each individual was able to choose a convenient time of their own volition to type questions and answers with as many details as possible before the scheduled interview. In addition, emails are instantaneous and easily accessible, thus negating the arduous task of organizing a time to meet with the participants and reducing the risk of disrupting research timelines (Marks et al., 2017). To ensure that the participants provided detailed data in a timely manner, they were assured anonymity. Furthermore, the participants were also provided the opportunity to edit the formatted answers in order to minimize errors, clarify certain topics and issues, and improve reliability of the data obtained (Surmiak, 2018).

**Research Method and Design**

The qualitative methodology was appropriate for the research, particularly with the case study methodology. The flexible design of the qualitative methodology coincided with the fluctuating nature of the supply chain industry, which continuously evolves because of both the rapidly changing trends in society and the various methods of attacks that supply chain businesses face. The qualitative methodology is also ideal for collecting information and data
through interactions with the participants involved in the affairs of the topic being researched (Haloukas, 2019).

The quantitative methodology is suitable for understanding the relationship between dependent and independent variables by way of statistical methods, which requires data that are quantifiable (Morgan et al., 2013). Additionally, a quantitative methodology is primarily used to test hypotheses, which means that quantitative research is not preferable for exploring strategies to mitigate supply chain disruptions (Bondwe, 2019). As for the different qualitative methods, the case study was chosen because of the research’s structure, which involved understanding the need for enhancing supply chain security. To understand the phenomena, information that could help contribute to the research must be obtained through first-hand accounts of the participants to create a better picture of the experience (Brown, 2020).

While the phenomenological methodology sounded ideal for the research, the focus on understanding how supply chain disruptions were successfully prevented or mitigated would be lost by way of expansion beyond the scope of the research (Bondwe, 2019). Likewise, the grounded methodology, while initially considered for the research, was not chosen as the methodology because the focus would have been on the theoretical inquiries instead of what has been objectively established concerning risk mitigation strategies (Mayounga, 2017). Finally, the ethnographic methodology was irrelevant to the study because while organizational culture may be a factor in a business’s response to supply chain disruption, organizational culture was not the main cause or issue (Bondwe, 2019).

The pragmatism paradigm was appropriate because the paradigm coincided with the flexible nature of a qualitative case study methodology. The aim of the pragmatism paradigm was the implementation of whatever is most applicable in research without being limited by a
specific philosophy or reality (Kaushik & Walsh, 2019). Therefore, the pragmatism paradigm was appropriate for a research topic that changes at a rapid pace and can easily be greatly impacted with widespread effects.

**Population and Sampling**

The purpose of this qualitative case study was to understand the various ways the supply chain industry incurs disruption from the lack of enhanced security and the development of potential ideas on how disruptions receive mitigation. The development and implementation of risk and disruption mitigation strategies affect the processes and organizational culture of supply chain organizations. Therefore, the population of the research consisted of high-level employees of supply chain organizations affected by supply chain disruptions. Obtaining first-hand accounts from the experiences of the participants was crucial to understanding how supply chain organizations recover from and respond to supply chain disruptions.

DiGaetano (2013) defined sample frame as the listing of the units from which a sample is selected. The most common example of a sample frame in research and studies is a survey, in which the researcher must consider the extent of the coverage of the target population. In other words, the population is the general group while the sampling frame is the specific individuals or things within the group. For the research, the population is the participants, which are the employees of the supply chain organizations afflicted by the disruptions, while the sampling frame would be the specific job titles of the participants. In consideration of the participants’ anonymity and confidentiality, the names of the participants and the organizations they work for were excluded from the research to ensure both confidentiality and details to further the research.

The sampling method used for the research was purposeful sampling to identify the potential participants of the research. Purposeful sampling is a technique used in qualitative
research to identify and select cases in which information is plentiful by way of first-hand accounts from the participants, who are selected for that reason (Palinkas et al., 2015). Since the research was focused on a single phenomenon, albeit numerous supply chain organizations, in which data are collected from the first-hand accounts of the participants, the purposeful sampling technique was appropriate.

In qualitative research, researchers often debate how small or large the sample size must be, often sourcing the answer to be dependent on various issues, such as methodological, practical, and ideological issues (Vasileiou et al., 2018). Sample size is the number of samples in research that is compared to the previous analysis of collected data and samples to identify any similarities and differences (Malterud, 2016). Ideally, sample sizes are relatively small in qualitative research and are often dictated by the results of data saturation, which is when the data collection process reaches the point where any additional data and information produces little to no change to the overall data collected (Tran et al., 2016). Therefore, data saturation must be achieved through continuous follow-up contact until the information gathered becomes mostly consistent to the point where any further information gathered will have little to no significant impact on the research; Guest et al. (2006) argued that fifteen is the minimum sample size acceptable in qualitative research.

The purpose of the qualitative research is to understand how to improve supply chain security. The population, which is the participants of the research, must be questioned to obtain first-hand accounts necessary for understanding the situation and developing potential solutions. Since the participants consisted of employees of high levels, the questionnaire was designed to obtain detailed information on how supply chain disruptions affected the organization and the
response and recovery processes from diverse perspectives. The follow-up contact continued until data saturation, the point at which additional data would not influence the outcome.

**Data Collection and Organization**

All qualitative research requires data to be collected and compiled to support the research. Both new and existing data are implemented into the research to better understand any changes between the different times the research was conducted. Obtaining the right data in qualitative research is crucial in understanding the issues the research focuses on and the potential solutions to mitigate the issues. To ensure that the proper data were collected, a robust data collection plan was required that guaranteed credibility and validity with methods to obtain detailed information while abiding by ethical guidelines. Data collection is the main method of answering research questions by way of interacting and building trust with the participants of the research (Bondwe, 2019). Some of the methods in collecting data include surveys, interviews, questionnaires, observations, archival documents, and existing data from past research. The primary method for collecting data in the qualitative case study in researching the measures to enhance supply chain security were questionnaires for participants through email and then a scheduled interview through voice chat.

During the questionnaire process, validity and reliability must be guaranteed in order for the qualitative research to be credible. Member checking is a technique for ensuring credibility of results by validating the participants (Birt et al., 2016). Data are often returned to participants to be checked for accuracy and significance with the participants’ experiences, which ensures authentication of both the data and participants. While the development of comprehensive research questions is imperative for qualitative research, the use of questionnaires is a frequently employed method for data collection. The idea of a qualitative research, especially in a case
study, is to obtain diverse data from multiple perspectives. As such, the questionnaire had follow-up questions and contact when the need arose, such as obtaining new information connected to the previous collected data that required revisits to achieve consistency. Topics and questions usually have follow-up questions because researchers modify the questions to best fit the context of the researcher and participant (DeJonckheere & Vaughn, 2019).

The researcher is responsible for analyzing, compiling, and objectively presenting the data while maintaining integrity and avoiding biases to achieve robust and truthful results (Bondwe, 2019). The researcher must collect first-hand information as data for the qualitative research serve as research materials for the systematic investigation. However, bias from both the participants and researchers is an ever-present danger that can negatively damage research, particularly in qualitative research. Qualitative research primarily uses inductive reasoning as opposed to a quantitative research’s deductive reasoning. Therefore, measures must be taken to not only address the presence of bias and the negative impact of bias on the research, but also to mitigate bias. For the qualitative case study on enhancing supply chain security, participants were guaranteed confidentiality pertaining to personal information and critical information regarding the companies involved.

Primary research is when the researcher collects first-hand information as data and research materials for the qualitative research, whereas secondary research is when the researcher relies on existing research material to draw new findings (Squires et al., 2020). Both were utilized in the qualitative case study to not only continue what previous research established in the field of supply chain security enhancement and disruption mitigation, but to also gain new information and data to further portray the progress made since the previous research. The data were collected from answers in the questionnaire provided to the participants (see Appendix A)
in line with contact protocol (see Appendix B). The questionnaire was formatted to be open-ended to allow for detailed discussions and answers from participants based on their experience. The questions on the questionnaire were developed based on previous research on enhancing supply chain security and mitigating supply chain disruptions. The protocol in interacting with the participants was structured to engage the participants into a safe environment with measures to guarantee confidentiality while allowing for the chance to personally review any collected data compiled into answers for accuracy. Any inaccuracies addressed were adjusted accordingly.

Since the data collected from the participants was via an initial emailed questionnaire, they were organized and stored in an electronic database. Each question and reply were documented to organize all the responses from participants while still ensuring protection of the participants’ identities (Haloukas, 2019). Data collected from the interviews were sorted by themes discovered that correlated to concepts discussed previously. The data were then returned to the participants to be checked for accuracy and corrected accordingly in order to ensure credibility, reliability, and validity.

Data Analysis

Qualitative data analysis can involve both deductive and inductive approaches to interpret data, but can also be a complex and time-consuming task, particularly when the researcher is a novice without a clear-cut guideline to analyze qualitative data with certain methods (Azungah, 2018). The purpose in qualitative data analysis is to categorize all the data collected from the participants into specific categories, discern similarities or differences, and find themes. Data analysis in qualitative research is usually accomplished by coding.

Coding is widely popular among qualitative researchers because of the main function in connecting themes and data (Parameswaran et al., 2020). Of course, the drawback of coding is
that it has the potential of taking away the participant’s voice through word reduction and lack of joint interaction between the researcher and participant. Some methods of coding in qualitative research include transcripts of interviews, images, and journals with a focus on interpreting the differing data. For the qualitative case study, the participants’ words and phrases pertaining to the implemented strategies will be categorized into themes, such as employee engagement, performance measurement, and lean and change management.

Triangulation is the cross-checking of data and interpretations within and across the categories of participants by two qualitative researchers (Cypress, 2017). Triangulation is a method to ensure validity in research, as the idea is to collect different sources of information and look for convergence. Since the purpose was to look for convergence, validation was obtained by having two different research methods and perspectives achieving similar results. Therefore, the qualitative case study also drew from previous research on supply chain disruptions to find convergences on the effects of disruptions and strategies that were implemented to mitigate the effects and occurrences.

Qualitative researchers use software tools for qualitative data analysis because of the major breakthroughs in technology simplifying the coding process, despite the initial rejection of the potential dehumanization aspect (Cypress, 2019). While many utilize tools like NVivo or ATLAS, this case study implemented Microsoft Word because of its simplicity and effectiveness. The basic review function in Microsoft Word and the macro tool allowed for turning answers in the questionnaires into coded text, which were used to categorize certain words and phrases into themes (Peach, 2014). Therefore, Microsoft Word was the software tool for qualitative data analysis for the research.
The data collection process primarily involved questionnaires initiated by email and then answered in an interview because of the COVID-19 pandemic requiring consideration for the safety of both the researcher and participants. The questions (see Appendix A) were open-ended questions that allowed for follow-up questions and answers to ensure that the data provided by the participants and collected by the researcher were detailed as much as possible. With the detailed data collected, the researcher interpreted the data by compiling them with a coding software in Microsoft Word, conducted follow-up contact and questions wherever necessary until no new information was obtained, cross-referenced the data from previous studies, and presented the data interpretation to the participants to check for accuracy.

Reliability and Validity

Researchers must ensure reliability and validity in research to create consistent and accurate results and to provide a solid bedrock for future research (Brown, 2020). Reliability is guaranteed by making sure that the major findings in qualitative research is dependable while validity is accomplished by making the study credible, confirmable, and transferable (Haloukas, 2019). As stated previously, member checking was implemented to ensure credibility of all data and results by validating the participants, which was accomplished by returning any collected data to the participants to be checked for accuracy before being used for the research (Birt et al., 2016).

Another method in the data collection process to ensure reliability and validity was data saturation. As described in the population and sampling section, data saturation is the point in the data collection process where any additional information or data have very little or no impact on the research and data that are already collected (Tran et al., 2016). Data saturation was accomplished in this qualitative research by continuously interacting with the participants with
follow-up questions and collecting data from each participant until any further results displayed little variation.

Bracketing is when the researcher draws from their own experiences to create presumptions of the kind of data that might be collected from participants (Johnston, 2017). However, qualitative researchers must take care to avoid personal biases when collecting data and interacting with the participants, as biases can hinder the credibility, reliability, and validity of the research. Therefore, the researcher for the qualitative case study on enhancing supply chain security noted that any personal experiences that may be relevant to the research but interact with the participants and collect data as though the knowledge in the field is lacking. For example, the researcher included basic military experiences in which shortages or delays in delivery of supplies result in either delays or cancellation of operations, both of which correlated to reduction in productivity and increased vulnerability of the organization.

Reliability and validity are crucial to any research, as the two aspects provide objectivity and facts into the interpretations of data and research findings instead of subjectivity clouding the facts (Cypress, 2017). Therefore, several methods were implemented in the qualitative case study to ensure most of the data interpretations were objective while subjectivity was relegated to ideas and follow-ups of questions and future research studies. Some methods included bracketing, data saturation, and member checking, which not only guaranteed reliable and valid data and research findings, but also consistent and transferable results for future research.

Transition and Summary of Section 2

Section 2 involved a detailed explanation of the purpose of the qualitative case study on enhancing supply chain security and mitigating supply chain disruptions, the role of the researcher, the participants and population, the data collection methods, and reliability and
validity of the data collected. The researcher ensured that the participants recruited for the research are guaranteed confidentiality both in his or her identity and some crucial details about the organization he or she works for. The participants included a mix of high-level employees and managers to ensure that the perspective of the situation and potential solutions were diverse and painted a bigger picture. The data were collected from the questionnaires that the participants took the time to answer with as many details as possible in both text and voice chat, which were then formatted and returned to check if the formatted data were properly presented. The data collection process not only included collecting first-hand accounts, but also follow-up contact to ensure reliability and validity. The results of the research provided important information for the supply chain industry on enhancing supply chain security and processes.
Section 3: Application to Professional Practice

This qualitative case study was created to understand how and why supply chain disruption occurs and to develop potential solutions to mitigate supply chain disruptions. The main occurrence for disruption was delays caused by policy changes or late deliveries, particularly because of the COVID-19 pandemic. Research questions were developed to ask participants and learn more about supply chain disruption mitigation. Eleven participants partook in an interview to answer questions pertaining to understanding how and why supply chain disruptions occurred, and what strategies were developed and implemented to mitigate supply chain disruptions. While the study initially focused on major threats like terrorism or internal factors like cyberinfrastructure complexities, the results of the data collection process had shifted the focus towards common factors that result in supply chain disruptions, such as delays, policy changes, late deliveries, and human error. Ten of the eleven participants had stated the common factors as the main source of supply chain disruption, which had resulted in not only the shift in focus towards common supply chain disruption risks, but also the recurring themes discovered from the data collection process.

Presentation of the Findings

The purpose of this qualitative case study was to understand the various ways the supply chain industry incurs disruption from the lack of enhanced security and the development of potential ideas on how disruptions receive mitigation. The shipping ports in the western region, such as Maersk, Long Beach, San Diego, and Los Angeles have seen cyberattacks in recent years, which resulted in disruptions that have negatively impacted supply chain businesses and their customers (Cimpanu, 2018; Nero, 2018; Ng, 2018). As such, these ports served as examples for why the supply chain industry is in dire need of enhanced security. Furthermore, the
cyberinfrastructure that resulted from the vast developments and innovations of information technology has created numerous vulnerabilities alongside the efficiencies, resulting in the need to address technology as a major factor in enhancing supply chain security (Forte et al., 2016). The result of this study could provide insight to the issue of the vulnerabilities in supply chain security, the risks of supply chain disruptions, and develop potential ideas for more efficient supply chain security practices, which could also result in higher long-term productivity (Adams, 2018).

A thematic analysis was used to identify the themes as answers to the research questions presented earlier. A thorough research was conducted by interviewing eleven high-level logistics and supply chain managers after obtaining the approval from the Institutional Review Boards (IRB) and the consent from the participants after ensuring confidentiality. The names and identifying details of the participants and their companies will remain confidential, but all the companies were of the logistics and supply chain industry. After establishing contact, an interview was scheduled for each participant at different times and dates through voice chats for convenience and to further ensure confidentiality. Afterwards, contact with the participants was continuously maintained to provide the participants with the answers compiled and transcribed into data for review. The method implemented was member checking, a technique that ensures credibility of the results by validating the participants (Birt et al., 2016). The participants were provided the compiled data to be reviewed for accuracy and significance with the participants’ experiences, therefore guaranteeing validity and reliability of both the data and participants while also remaining confidential about crucial identifying information. Reliability is the data and findings being dependable while validity is the credibility of the study, both of which must be achieved in qualitative research (Haloukas, 2019).
Themes Discovered

A thematic analysis was conducted to answer the questions, and the following themes were identified: (a) impact of supply chain disruption, (b) continuous communication, (c) performance measurement, (d) employee empowerment, (e) quality management, (f) lean and change management, and (g) resilient supply chain. The themes were identified using the coding software in Microsoft Word, which included a macro tool that allowed for compiling comments made throughout the document into categories (Peach, 2014). The categories were the resulting seven themes identified in the interviews, which were compiled into Table 1 below.

Table 1

Data Table Displaying the Themes Identified through Coding

<table>
<thead>
<tr>
<th>Themes</th>
<th># of Occurrences</th>
<th>% of Occurrences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous communication</td>
<td>8</td>
<td>0.73%</td>
</tr>
<tr>
<td>Employee empowerment</td>
<td>4</td>
<td>0.36%</td>
</tr>
<tr>
<td>Create an understanding environment for employees</td>
<td>6</td>
<td>0.55%</td>
</tr>
<tr>
<td>Performance measurement</td>
<td>8</td>
<td>0.73%</td>
</tr>
<tr>
<td>Quality management</td>
<td>8</td>
<td>0.73%</td>
</tr>
<tr>
<td>Lean and change management</td>
<td>9</td>
<td>0.82%</td>
</tr>
<tr>
<td>Resilient supply chain</td>
<td>8</td>
<td>0.73%</td>
</tr>
</tbody>
</table>

Adapted from Table 1 by Haloukas (2019)

Interpretation of the Themes

The seven themes discovered from the participants’ answers to the interview questions shown in Table 1 above were based on recurring answers to some of the questions. The questions were tailored to finding themes for this research to analyze and understand potential factors to supply chain disruptions and any strategies developed and implemented to mitigate supply chain disruptions.
Theme 1: Impact of Supply Chain Disruption

The first theme is the main theme of this doctoral research and the result of all eleven participants’ answers to the interview questions. This theme was not included in Table 1 above because all the participants had answered and described the impact of disruption to the supply chain. However, the reason this theme was included in this research is to emphasize the fact that disruptions to the supply chain can range from minuscule to enormous and still cause significant negative impact to the supply chain industry. The first interview question asked to all the participants for this research was to understand the effects on the participants’ respective organizations as a result of supply chain disruptions. All the participants provided varying levels of impact on their organizations, ranging from missed deliveries to major policy changes as a result of the COVID-19 pandemic. Regardless of the different factors that caused supply chain disruptions, the resulting disruption had negative impacts on the supply chain, such as declining sales, cost increases, and service delays or failures for numerous supply chain businesses (Park et al., 2016). Additionally, regardless of the level of impact the disruptions had on the supply chain, the resulting delay in production or delivery had significant impact on the supply chain process, which is especially devastating in the modern era since the supply chain process is much faster and the demand for faster deliveries is high.

While this research does acknowledge other threats and factors that would result in supply chain disruption, such as terrorism or cyberinfrastructure complexities, the main factor of supply chain disruption is the COVID-19 pandemic. Only Participant 09 had linked the source of supply chain disruptions to terrorism or cyberinfrastructure complexities, stating that the “most dangerous threat to the organization’s supply chain security were hackers and criminals working together as a threat to cybersecurity” (Participant 09). All except Participant 09 had provided
rather simple and common factors, such as change in policies or delays in production, transportation, and deliveries. These sources of disruptions may not be as severe as factors such as terrorism, but the resulting negative impact highlights the importance that all risks of supply chain disruptions must be accounted for and mitigated. All eleven participants had described in the interviews that even the smallest level of supply chain disruption resulting in delays can negatively impact supply chain businesses, which was also highlighted by Revilla and Saenz (2017). Participant 09 stated that, “Disruptions in the supply chain pose serious threats from an economic standpoint. Interruptions in the supply chain not only create higher prices and shortages among consumer products, supply chain disruptions impact inflation, factory closures, and goods that are in high demand in a society as a whole.” The recent COVID-19 pandemic is a testament to how supply chain disruptions can severely affect both businesses and customers, as the virus created a harmful environment for everyone and had resulted in almost every business to either shut down or to drastically change policies and procedures in order to continue conducting business safely. However, the process of the policy and procedure changes was a lengthy process that also resulted in numerous trial-and-error and losses in profit. Therefore, supply chain businesses must account for any risks of supply chain disruptions by having good risk management plans, a notion supported by Bier et al. (2019). None of the participants put it better than Participant 05, who stated that “the supply chain is exactly like a chain, meaning that one bad link will break everything else.”

**Theme 2: Continuous Communication**

The theme of continuous communication was a result of eight of eleven participants’ answers to the sixth interview question. This theme emphasized the importance of maintaining continuous communication within the company in order for all the employees on every level to
remain informed of the required tasks and goals, as well as any of the changes made within the organization. Furthermore, the employees must also be informed of the reason behind the changes, as well as any shortcomings and immediate occurrences that result in disruptions, as it allows for the employees to be more understanding of the situation and appropriately adapt to the situation. Bourne et al. (2018) asserted that communication is key to answering critical questions addressed for the sake of improving a supply chain organization. Participant 07 supported the importance of communication by stating that, “the best way to enhance supply chain security and mitigate disruptions is effective communication at all levels starting with the initial request to the final procurement with a focus on right time, amount, and cost.” The theme of continuous communication coincides with several other themes listed in this research, such as performance measurement, quality management, and the creation of an understanding environment for employees.

Most participants of this research had stated that communications were very frequent, ranging from more than half a week to daily dedications of team meetings (Participants 02, 03, 05, 06, 07, 09, & 11). Participant 05’s organization had utilized daily communication by having “good communication platforms with different apps and a strong and secure email system” that “goes throughout the structure in our organization which we use on a daily basis and allows everyone to stay in the know,” and that “it’s all about getting that communication daily and easily accessible.” Strong and effective communication within the organization can also be utilized for performance measurement, particularly with the provision of positive incentives such as metrics of performance standards to all employees (Mangan et al., 2012). Furthermore, having continuous communication within a supply chain organization, or even with other organizations with business ties, is both crucial and appropriate, as the market environment is changing on a
frequent basis, a pace in which communication within a supply chain organization should match. Performance measurement plays a crucial role in any organization’s operations as a result of effective organizational communication (Bourne et al., 2018).

**Theme 3: Performance Measurement**

The third theme coincided with the previous theme in that continuous communication was the most common method of many supply chain organizations to create a supportive work environment and improving organizational performance (Kamble & Gunasekaran, 2019). Furthermore, continuous communication is another method to ensure quality management, which will be discussed as the fifth theme. Bourne et al. (2018) also attested to the combination of continuous communication and performance measurement, as the latter can play a critical role in a supply chain organization’s operation because of the former. Most of the participants had mentioned the use of performance measurement in the assessment of the effectiveness of their implemented strategies to mitigate supply chain disruptions (Participants 01, 02, 06, 07, 08, 09, 10, & 11). The assessments were mainly concentrated on whether or not the strategies yielded the desired results of their organization, and if the results were not meeting the satisfactory requirements, then adjustments and modifications were made to the previously implemented strategies to achieve better results. Participant 06 mentioned that most of their performance measurements stemmed from “sales, customer feedback, employee engagement surveys, and then also in our calls that are one day a week,” which supports the notion that the latter two measures coincide with the previous theme of continuous communication and the following theme of employee empowerment.

Information sharing is another concept to be considered in addition to the theme of performance measurement. Information sharing allows for shared communication within or
beyond a supply chain organization for the purpose of improving business and operations (Laihonen & Pekkola, 2016). Participant 02 stated in the interview that their organization “looked at how other organizations did their operations, saw what worked and what didn’t, and implemented the strategies that worked into our own to improve our processes.” Furthermore, Participant 02 included that “obstacles were addressed by having open communication in our organization,” which harkens back to the previous theme of continuous communication and correlates to the following theme of employee empowerment.

**Theme 4: Employee Empowerment**

Employee empowerment is another method besides continuous communication to ensure quality management, as ensuring employees remain positively motivated to continue their work results in higher productivity. Unmotivated employees is one of many major risks in supply chain disruptions, but many other factors can contribute towards unmotivated employees, all of which must be taken into careful consideration by managers in supply chain organizations. For example, reducing wages would not warrant good behaviors or incentives to work harder, especially in a business in which employees are not scrutinized or monitored properly, therefore creating large vulnerabilities in supply chain security that can be easily exploited by both internal and external factors and result in supply chain disruption (Belzer & Swan, 2011). However, only a few participants had provided answers pertaining to employee empowerment, which involved allowing employees to participate in developing potential solutions to improve efficiency within their organization or ensuring employees are properly trained in their positions to be trusted to accomplish their tasks without needing extra supervision (Participants 01, 06, 10, & 11). As seen in Table 1, the reason why only four of eleven participants provided answers and examples of
employee empowerment is because the rest had focused on their organizations creating an environment that allows for employees to be very understanding of the situation.

Six of the eleven had created an organizational environment where employees were very understanding of every situation and whatever strategies were implemented (Participants 04, 05, 07, 08, 09, & 10). The concept of creating an environment in which employees were most receptive and understanding to the changes implemented by the management level of a supply chain organization must also correspond to the previous theme of continuous communication because employees were far less receptive and understanding when they were essentially kept out of the loop regarding changes to policies and procedures. Furthermore, Participant 04 asserted that, “there needs to be an understanding of why things are the way they are, such as why prices are increasing and why operations are slowing down. Companies nowadays have been getting better at accepting and understanding any changes or negative impacts, but it’s important not only to have this in your own organization, but also with suppliers and customers.”

Ensuring employee consideration also ensures employee motivation and commitment, both of which are necessary for maintaining and improving efficiency within a supply chain organization (Po et al., 2019). Additionally, employee consideration correlates to the following theme of quality management. Participant 10 shared that their organization’s “procurement employees participated in the brainstorming strategy to enhance data digital signature, enabling logistics division to develop procedures to strengthen checks and balances that reinforce processes.”

**Theme 5: Quality Management**

Quality management is a top priority for many supply chain organizations because of the industry relying on changing trends, customer feedback, and quality provision of products and services. Quality management is also the method for attaining, sustaining, and advancing quality
necessary for enhancing business, ensuring competitiveness, and meeting (or even exceeding) customer needs and expectations (Plenert, 2012). Almost all supply chain businesses have a strong focus on quality management because the modern market environment has become fast-paced to meet changing consumer-driven trends. Therefore, customer satisfaction is integral to ensuring that supply chain businesses continue functioning, which is why the concept of quality management was mentioned by eight of the eleven participants in this research (Participants 01, 02, 03, 05, 07, 08, 09, & 11). Additionally, quality management is a concept that can only be accomplished when performance measurement is implemented into a supply chain organization’s system (Wei et al., 2019). To accomplish quality management with performance measurement, the system must be designed to be innovative with a clear emphasis on the goals between employees and the supply chain organization (Wei et al., 2019).

Benavides-Chicón and Ortega (2014) had stated that employee training and motivation can influence productivity. Therefore, the theme of quality management coincides with the previous theme of employee empowerment and performance measurement. Putri et al. (2017) had studied and discovered that predominant factors that positively affect employees’ productivity result in the quality management program’s success but achieving this success would require a high level in employees’ commitment to their organization. Since the market environment had also resulted in most supply chain organizations emphasizing customer satisfaction, quality management is most ideal to integrate into supply chain management (Fernandes et al., 2017). Quality is one of the main demands by the customers, and since trends change at a rapid pace because of customer demand, quality is also just as dynamic and fast-paced, which means that quality management must involve a continuous improvement process.
Therefore, quality management connects to the following theme of lean and change management.

**Theme 6: Lean and Change Management**

Lean management and change management mostly coincided with each other, as both concepts focused on flexible designs for supply chain organizations to properly adapt to the changing nature of the current market environment. Supply chain organizations nowadays are constantly adjusting their policies and procedures to be more adaptive to the changes while maintaining efficiency. Abdallah et al. (2019) attested to lean management’s effectiveness in positively impacting performance with methods that highlights adapting to changes by providing an example with Japan’s industrial success attributing to lean management. The goal of lean management is to improve efficiency in products and services while reducing any defects and excessive inventory level. The theme of lean and change management was one of two with the most occurrences in the data collection from the participants, which is appropriate because of the need for flexibility and adaptability in the modern market environment. Since the environment is rapid and dynamic, lean management is crucial in developing strategies and contingencies to maintain efficiency while change management is important in an organization being flexible enough to adapt to new trends and demands. For example, Participant 01 stated that, “there are various factors we take into account, such as whether or not the same production line that produces one product will produce another product. This doesn’t work in a practical sense because the mitigation strategies themselves aren’t universal due to different circumstances and factors. Each supply chain disruption is singularly independent.”

What separates quality management from lean and change management is that the former is more generalized in the goal of developing measures to achieve quality while change
management is a method in quality management that is specifically designed to adapt to different situations and improving efficiency (Abdallah et al., 2019). They found the impact of quality management on the efficiency of a private hospital’s operational performance exerted very little to no impact on efficiency, even though quality management only had a positive effect on quality performance. Instead, lean management was discovered to be the ideal measure to implement because of the adaptive measures and procedures properly suited to account for any sudden changes in the internal and external environment that contributes to the risks of supply chain disruptions. Participant 04 even stated that, “we had to be as creative as possible in terms of multi-strategy. It’s not one strategy, but a lot of different actions to implement a strategy, so it’s kind of like lean management with a number of contingencies with good change management.” As such, the importance of lean management was emphasized by the fact that the concept of lean and change management had the most occurrence in this research alongside the concept of resilient supply chain.

**Theme 7: Resilient Supply Chain**

The final theme discovered in this research was the concept of resilient supply chain. Similar to the concept of the previous theme of lean and change management, resilient supply chain focuses on business designs conforming to any rapid changes in the market environment produced by market demand. Market demand is a byproduct of changing trends, but other factors such as manufactured or natural disasters can also affect supply chain businesses. A resilient supply chain business is designed to counteract such man-made or natural factors to achieve customer satisfaction that drives the market demand (Ellura et al., 2019). A resilient design is also both proactive and reactive, in which the former focuses on eliminating or mitigating risks and threats before a disruption occurs while the latter has the same focus but during a disruption.
Supply chain businesses have made significant strides and improvements in sales and procedures as a result of numerous strategies, such as lean practices, just-in-time deliveries, and global outsourcing (Jabbarzadeh et al., 2018). One example of a resilient design is with the Nissan Motor Company Ltd in Japan after the earthquake of 2011, in which the company’s design accounted for the impact caused by a natural disaster and recovered faster and more efficiently than its competitors that had also suffered, some of which had a robust design that was not ideal for recovery (Rezapour et al., 2017). Nissan had accomplished this by having access with other providers, which is consistent with Participant 01’s statement in how the participant’s organization had “sought out alternate manufacturers if the current manufacturer was unable to meet the deadline.” Additionally, Participant 06 included that there were moments where the participant’s organization “didn’t always have an emergency plan, but some of you will realize things like COVID and other things that made you realize there were gaps in your emergency plans.” Disasters like the COVID-19 pandemic unfortunately becomes necessary eye-openers to help a supply chain organization realize that backup plans are needed to account for any disasters and maintain efficiency and productivity, which further supports the previous notion that a resilient supply chain design is necessary in the modern age. Even without any external factors like the pandemic or natural disasters, the market environment itself is dynamic and rapid, which means that a resilient design is practically necessary for supply chain organizations (Siegel, 2018). As such, nullifying risks of supply chain disruption is impossible, which means that modern supply chain organizations must be dedicated to proactively identifying, addressing, and mitigating supply chain disruption risks.
Representation and Visualization of the Data

Table 1 was the result of the coding software in Microsoft Word to identify the themes in the research data obtained from the participants. As mentioned in the discussion of the first theme, the impact of supply chain disruptions was not included in the table because all eleven participants answered the first interview question by describing in detail the factors that caused supply chain disruptions and the impact disruptions had on their respective supply chain organizations. Supply chain disruption is the central theme of this research, which meant that while the theme was to be discussed, there was no need to include the theme in the data. The rest of the themes in Table 1 were concepts discussed in Section 1 of this research with the exception of continuous communication and, to a lesser extent, employee empowerment. Rather, the two themes are more details that correlate to the other themes.

The remaining the themes displayed on Table 1 were analyzed based on the answers provided by the participants and the questions asked. The concepts of lean and change management and resilient supply chain had the most occurrences followed by continuous communication, performance measurement, and quality management. The concept with the least number of occurrences was employee empowerment, but an additional concept discovered and used as a theme in this research was the creation of an understanding environment for employees. As shown in Table 1, the themes of lean and change management and resilient supply chain had the most occurrences because most of the participants had provided answers pertaining to measures developed and implemented by their supply chain organizations designed for flexibility and adapting to the numerous changes brought about by the market environment.

Since the common solutions suggested in Section 1 of this qualitative research involved different measures to adapt to any positive and negative changes, it makes sense that the
concepts of resilient supply chain design and lean and change management had the most occurrences. The next three themes with the most occurrences following the first two were quality management, performance measurement, and continuous communication. However, the three themes were measures of implementation for supply chain organizations to improve efficiency and productivity, which show that numerous participants’ organizations had implemented measures pertaining to quality management, performance measurement, and continuous communication. The connection between the three themes is the goal of achieving the best results in terms of sales, costs, efficiency, and productivity with the use of continuous improvement. Quality management’s core concept is continuous improvement, while the themes of performance measurement and continuous communication are the means to achieve quality management; performance measurement analyzes the organization’s performance in processes and employees while continuous communication is the means to update all employees on any changes, preferably on a frequent basis. Finally, the last two themes with the least number of occurrences were the creation of an understanding environment for employees and employee empowerment.

**Relationship of the Findings**

The findings of this research as a result of the interview and data collection relate to the key areas of the research proposal, particularly with most of the concepts discussed in Section 1. Almost every concept established in the referenced peer-reviewed articles, past dissertations, and information developed in Section 1 of this research coincided with the findings of this research during the data collection and interview process. The findings correlated to the research questions, conceptual framework, anticipated themes from Section 1, the literature, and the problem.
Research Questions

The interest in the qualitative case study to answer the research questions developed in the initial research process in Section 1. The research questions are listed below:

RQ1: Why is the supply chain industry lacking enhanced security?
   - RQ1a: What factors have contributed to the success in supply chain security?
   - RQ1b: What factors have contributed to the failures in supply chain security?

RQ2: What strategies can supply chain industries implement to reduce disruptions?
   - RQ2a: What strategies have worked against supply chain disruptions?
   - RQ2b: What strategies have aggravated the negative results of supply chain disruptions?

RQ3: How can businesses work to both implement and maintain the strategies that minimize supply chain disruptions?

The three research questions were initially written to understand from a basic standpoint the cause and effects of supply chain disruptions and the potential solutions to improve supply chain solutions while the sub-questions were designed to understand what establishes success and failure in supply chain security. The research had begun with exploring the details of the numerous modern examples of supply chain disruptions caused by malicious factors, such as the criminal cyberattack on Maersk (Cimpanu, 2018). Therefore, the first research question was intended to understand the why of the situation, the second research question was to address the development of potential solutions to supply chain disruptions, and the third question was to focus on the implementation of the potential solutions.

However, as the research progressed with the development of the interview questions (as shown in Appendix A) to ask the participants of this research, the questions shifted towards
supply chain disruptions and the mitigation of disruptions while focusing less on the security aspect. The reason the concept of supply chain security was focused on less in this research was because the issue addressed during the interview and data collection was the concept of supply chain disruptions and the strategies developed and implemented to mitigate the disruptions. In addition, the other reason why the focus had shifted is because the most dangerous type of supply chain disruption is one that can occur frequently instead of the kind that, while the results can be catastrophic, are not nearly as frequent. The research lacked answers from participants pertaining to criminal and terrorist threats in which security is needed to counteract such factors, although Participant 09 was the only one who mentioned the threat of criminals and hackers. Instead, the security aspect of this research is very basic, meaning that the focus is on ensuring that supply chain disruptions are mitigated and businesses continue to function.

The first question was tailored to understanding the effects supply chain disruptions had on the participants’ organizations because supply chain disruption is the underlying issue of this research. The negative impact of supply chain disruptions on businesses can be severe, and not only do disruptions affect the supply chain organizations, but also any other businesses associated with the organizations and the customers who purchase products and services from the supply chain organizations. All eleven participants answered that the impact on the supply chain was delays, which forced their organizations to look for different solutions and courses of actions to address the factors causing the disruptions, the impact of the disruptions, and measures needed to continue business operations. The most frequently stated source of disruption at the time of data collection from the participants’ perspective was the COVID-19 pandemic, which required most supply chain businesses to adjust policies and procedures to accommodate to both
public safety regulations and the customers that continued to rely on the supply chain organizations for business.

The second question focused on understanding different strategies the participants’ organizations developed and implemented. Numerous participants had provided answers related to implementing measures designed to adapt to the changes with varying degrees of success. Some measures were successful quickly while others were not as successful and had to be readjusted to be more effective, which usually resulted in the themes of lean and change management and quality management. The strategies provided by the participants consisted of having to develop new schedules or routes, third party logistics, and scaling up or down some products while balancing lead times and efficiency of production centers. Of course, as Participant 01 had advised in the interview process, “the mitigation strategies themselves aren’t universal,” meaning that one strategy can work very well for one supply chain organization, but it may work very poorly for another, whether it’s because of different organizational culture, policies and procedures, or even the external environment.

The third question was a follow-up to the second question but focused on understanding the response from employees. This was where most of the participants responded with answers that resulted in the themes of employee empowerment or the creation of an understanding environment for employees. However, a few participants provided answers that involved employees who were not satisfied with the newly implemented measures and took some time to adjust to the new measures, which would require employees to conduct new tasks according to new policies and procedures (Participants 02, 05, & 06). While employee unsatisfied sentiments towards the sudden implementation of new measures, policies, and procedures was fairly understandable, the result supports the notion that supply chain organizations need to create and
encourage an environment where employees need to be more accepting of the sudden changes, especially since the supply chain industry is constantly changing at a rapid pace.

The fourth question was asked to compare and contrast the strategies implemented from the second question to the strategies the participants’ organizations developed and implemented from the past. The fourth question is also another follow-up to the second question. Most of the obstacles tend to be policies and procedures, but some participants like the third and fourth participants stated that their organization had developed numerous different strategies and implemented them either together or in quick succession. Participant 09, on the other hand, was the only participant to mention the threat of hackers and criminals to the supply chain, or rather specifically, cybersecurity.

The fifth question was asked to understand what obstacles the participants’ organizations encountered and the obstacles were addressed. The purpose of this question was to understand how past successful strategies compared to recent successful strategies in order to obtain a better understanding of how they had changed. This also provided insight into the degree to which the current market environment and the supply chain industry had changed. Since the question focused on comparing and contrasting past and modern strategies to mitigate supply chain disruption, the common answers from the participants resulted in the theme of lean and change management. Participant 01 answered this question by explaining that their organization took various factors into account and does not stick with the same mitigation strategies since the strategies themselves are not universal. Participant 03 also suggested that whatever the obstacle an organization encounters, “The strategy remains the same. Overcome the obstacle. Doesn’t matter what the obstacle is. If the strategy does not make financial sense, then either look for a different product or change your business model.”
The sixth question was asked to understand how strategies were communicated throughout the participants’ organizations, which mostly resulted in the second theme of this research: continuous communication. The reason communication was selected as a theme in this research is because communication is usually a key factor in ensuring operations run smoothly, which also means that lacking proper communication creates a larger risk of supply chain disruption. Participant 07 especially advised that, “effective communication at all levels starting with initial request to final procurement with a focus on right time, amount, and cost. Communication in all forms, to include actually verbal and written communication and knowing that people are speaking the same technical language.” Communication was important in all forms, whether verbal or written, and it was important to know that people were speaking the same technical language.

The seventh question was asked to find out if any modifications were made to the strategies that were developed and implemented to mitigate supply chain disruptions. Since the question focused on modifying implemented strategies to improve efficiency and productivity, the concepts that emerged from the participants’ answers to this question were either lean and change management or quality management. Almost all participants had mentioned measures including changing the process and changing transport routes; Participant 01’s organization had considered switching suppliers and manufacturers if the product delivery unable to be completed in a timely manner. Participant 09’s organization had to review, revise, and update its strategies to improve the effectiveness of supply chain security, which is something that the participant reasserted for the ninth question in what modern supply chain organizations should practice: “organizations must review, revise, and update supply chain security initiatives and strategies on a consistent basis. The organization’s leadership must remain vigilant and ensure that they stress
the importance of supply chain security and perform best practices daily to mitigate disruptions in supply chain operations. Organization must continue to expand on supply chain visibility of logistics operations, implement inventory management strategies to better track inventory levels, physically secure warehouses after goods are received and stored, and ensure that supply chain software remain current and updated to prevent and mitigate cyberspace threats from disrupting the supply chain.”

The eighth question centered on how the implemented strategies were assessed for effectiveness in mitigating supply chain disruptions. The numerous strategies implemented were assessed in the strategies’ efficiencies, which usually resulted in answers that coincided with the theme of performance measurement. Participant 06 added that their organization utilized “customer surveys and platforms where employees could make comments, but we also had a specific survey that we sent out to them around what was going on and to find out from them if there were any additional ideas or suggestions that they may have. We also have two or three conference calls a week. Now we're down to one day a week.” Having a process where everyone has a voice can provide numerous different insights that can be used to develop new measures to maintain or improve efficiency while ensuring customer satisfaction.

The ninth question was a final opportunity for the participants of this research to share any other thoughts or advice that were not addressed in the interview. Different advice provided by the participants usually consisted of extra anecdotes and advice to support concepts that were already established, albeit in a slightly different perspective. For example, Participant 01 established that organizations must try the absolute best to “minimize the negative as much as possible and accentuate the positive where it’s feasible,” Participant 02 stated that supply chain organizations should “think quick on their feet and implement changes while being willing to
adapt to those changes,” and Participant 03 advised not to “conduct business with other individuals or companies that are solely the ‘least cost’ alternative.” Participant 06 encouraged “to foster and create an environment where everybody’s ideas are welcome” and Participant 07 asserted that communication is crucial to an efficient supply chain process and must include “all forms, to include actual verbal and written communication.”

**Conceptual Framework.** Section 1 included a figure showing a diagram displaying the relationship between the elements discussed in the conceptual framework, which involved the general theory, agency theory, and contingency theory. The diagram was designed to display the relationship between the three theories, concepts, and elements of the theories. The elements that were noticeably absent in this research, particularly from the data collection in the interview process from the participants, included cyberinfrastructure complexities, differing leadership styles, and attacked organizations. The remaining elements that were addressed in this research included supply chain disruptions, enhanced security practices, leaders, changed policies and procedures, and potential bias from the interviewee. The bias from the participants, however, was not nearly prevalent because all the participants had simply described the effects of supply chain disruptions and the strategies implemented to mitigate both the risks and negative impacts. Some of the participants had also included the strategies that did not work, therefore requiring their organizations to re-analyze their strategies, make the necessary adjustments, and re-implement the new strategies for better results. Other details that the participants described in the interview were consistent with the concepts described in other credible literary sources and peer-reviewed articles, which resulted in the seven themes discovered and analyzed in the previous section.
The agency theory is used in qualitative studies to understand the relationship and differing goals between the agent and principals to avoid risks (Haloukas, 2019). Belzer and Swan (2011) applied the agency theory to understand the relationship between the government and supply chain businesses that represent the principal and agents, respectively. A few participants in this research had provided answers that apply to this example and concept, which commonly resulted in the principal having specific requirements that must be met while the agents had to adjust accordingly, especially when supply chain disruptions had created obstacles that forced the agents to make further adjustments. Participant 01’s organization especially had difficulty in ensuring that its suppliers were able to meet the criteria in a timely manner. However, Participant 01’s example had initially started as the agent while the government was the principal, but once Participant 01’s organization started working to meet the requirements, the organization had to present and enforce the requirements to be met by the suppliers, which shifted the agent and principal relationship to the suppliers and Participant 01’s organization, respectively.

The general systems theory is used to understand how the individual aspects of the supply chain relate to the external environment (Dey, 2016). The general systems theory would be the most applicable theory of the three because of how numerous factors in the external environment can influence the supply chain, which is why this research is focused on understanding supply chain disruptions and how to mitigate the disruptions in order to ensure supply chain businesses continue functioning and remain competitive. The general system usually focuses on the factors outside of the work environment, such as the global market demands. Other times, the general systems theory can be used to find the relationship between functions with different behaviors and structures, such as how information sharing can have positive outcomes like inventory
transparency, inventory levels reduction, and enhanced customer service (Katrakazas et al., 2020). As stated in the discussion of the theme of performance measurement, information sharing is an important concept for supply chain organizations to consider, whether it is communication within an organization or to other businesses and suppliers. Therefore, information sharing is also important when applying the general systems theory because of the theory’s concept of designing an efficient system by having all the different functions working together (Dey, 2016).

The contingency theory’s purpose is to understand how situational factors can impact the relationship between independent and dependent variables (Haloukas, 2019). Haloukas (2019) had used the examples of different strategies to counteract organizational issues as the independent variable while the result of whether or not the strategies were successful in addressing the issues as the dependent variable. Another example was when Tangpong (2019) used the contingency theory to explain the different managerial decisions in supply chain management, which establishes a difference between agency theory and contingency theory in that the former lacks the design to account for variables such as human agents with self-interest and risk aversion while the latter does. However, because contingency theory is commonly used as the main framework for behavioral research to understand how certain behavioral traits (e.g. personality, motivation, etc.) can influence business decisions that affect supply chain organizations, this qualitative research did not use contingency theory. The most contingency theory would have applied in this research were the themes of employee empowerment and the creation of an understanding environment for employees. The two themes entail scenarios and results involving employees’ contribution to their supply chain organizations with varying levels of productivity.
Reliability and validity must both be ensured by the researcher in a qualitative study to create consistent and accurate results while providing a solid foundation for future research (Brown, 2020). Member checking was also utilized by returning all the collected data back to the participants to be reviewed for accuracy (Birt et al., 2016). Furthermore, data saturation was included in the member checking process by continuously interacting with the participants with any additional questions (Tran et al., 2016). However, bracketing was impossible for this research because the researcher did not have substantial experience with work in a supply chain organization, which is needed to develop presumptions of the kind of data that might be collected from participants (Johnston et al., 2017). However, the data was mostly similar because of the presumptions that the information and findings established in the past dissertations, particularly the dissertations by Haloukas (2019) and Dey (2016), and other peer-reviewed articles would be similar. While the researcher did not have any substantial experience to compare and contrast with the findings provided by the eleven participants of this research, reliability and validity were still ensured, especially since very little bias was found during the data collection and interview process. Biases can hinder the credibility, validity, and reliability of any research, and the most dangerous biases are one that’s implicit and unnoticeable, but the participants were able to provide straightforward answers that coincided with the information and findings established in past research. Therefore, by ensuring validity and reliability, most of the data interpretations were presented objectively while subjectivity was relegated to potential solutions and ideas, all of which could inform recommendations for future research (Cypress, 2017).

**Anticipated Themes.** The findings relate to the anticipated themes based on the concepts discussed in Section 1 of this research. Most of the themes discussed in Section 1 of this research were discovered and addressed during the data collection process. All eleven participants had
providing answers that correlated to what was discussed of the themes in Section 1 with the exception of agency theory and general systems theory. In the order of most to least occurrences in the interview process, the following seven themes were resilient supply chain, lean and change management, quality management, performance measurement, continuous communication, the creation of an understanding environment for employees, and employee empowerment. The theme of the creation of an understanding environment for employees was mostly unanticipated because the main concept was intended to be employee empowerment, but more participants provided anecdotes about how an organizational culture where employees are very receptive to the changes implemented yielded success with only few examples where employees were provided the opportunity to voice their opinion and suggestions to improve their organization’s processes and efficiency.

The qualitative research did not have any missing themes, but three concepts established in Section 1 were not analyzed thoroughly in this section of the research, which consisted of the three theories: agency theory, general systems theory, and contingency theory. However, the three theories were discussed under the conceptual framework section of this part of the qualitative research, in which there were some applications of what was established by the participants of this research during the interview process to one of the three theories, such as the application of agency theory in the relationship between the government and supply chain organizations or the general systems theory in the relationship between factors that causes supply chain disruptions and different aspects of the supply chain.

The Literature. Numerous peer-reviewed articles were referenced to support the statements in the section discussing the themes. Therefore, the literature was mostly similar to the findings while the differences mainly lied in what was not discovered in the findings, such as
the lack of extreme factors like terrorism being the source of supply chain disruptions. As mentioned previously, the main focus in this research was to understand the factors that contributed to supply chain disruptions and potential solutions to mitigate any risks of supply chain disruptions, which the majority of the literature referenced in this research discusses.

Participant 09 was the only participant for this research to state that hackers and criminals were one of the biggest recent threats the participant’s organization encountered, which created challenges for the participant organization’s employees to develop cyberthreat countermeasure. The complexities of developing countermeasures to cyberthreats are consistent with an article by Forte et al. (2016), who stated that the complexity of the cyberinfrastructure alone is enough to cause disruptions, let alone cyberattacks described by Park et al. (2016) or terrorism threats described by Khan et al. (2018). Participant 09 stated that the “challenges of cyberspace security and cyberattacks posed the most dangerous threats because DLA did not know who and what cyberspace actors were planning and when they were planning to implement cyberattacks that caused supply chain disruptions.” Therefore, the initial plan was to detect the attack in the system, then configure their firewalls to properly defend against any attacks and connections from the hackers orchestrating the supply chain cyberattacks. Furthermore, the participant’s organization included a scorecard system with a resilient supply chain design to properly develop and implement measures to address supply chain security while ensuring the measures were continuously improving upon the previous measures when the need arose. While the research did not include the use of scorecards in the discussion of performance measurement, Participant 09 had described the use of scorecards with a resilient supply chain design to ensure supply chain security.
Most of this research and data collection was conducted in a similar manner to the data collection process conducted by Haloukas (2019) and Dey (2016). Once Table 1 was made, an analysis of the discovered themes was conducted to find the relationship between the themes and the concepts discussed in Section 1 of this qualitative research. In addition to comparing and contrasting what was discussed in Section 1, this section of the qualitative research also compared what was established in the referenced peer-reviewed articles and previous dissertations to what was discovered during the data collection and interview process.

**The Problem.** This research started with a goal to address the main problem, which was the lack of enhanced security in the supply chain industry resulting in supply chain businesses and customers negatively impacted. With problems ranging from complexities in the system to external factors that physically disrupt an organization, supply chain businesses suffer consequences, such as increases in costs, declining sales, and service failures (Park et al., 2016). Therefore, supply chain businesses have emphasized quality and customer satisfaction to ensure business operations continue to function, which is what this qualitative research focused on. Several questions were created to both understand the cause and effect of supply chain disruptions and to develop potential solutions to mitigate supply chain disruptions. Since nullifying supply chain disruptions is impossible, the goal for every supply chain organization should be to mitigate disruptions as best as possible.

However, there exists numerous different factors that contribute to supply chain organization that will inevitably result in supply chain disruption no matter how much an organization prepares for the factors. This means supply chain organizations must also develop and implement measures to adapt to the inevitable outcome that a disruption will occur causing negative impacts. As such, this research was designed with a clear focus to understand the
factors that cause supply chain disruptions and the strategies to mitigate the risks and impact of supply chain disruptions. This research involved questions to ask several participants consisting of high-level employees of supply chain businesses in order to find recurring themes, particularly themes that matches the concepts discussed in Section 1 of this research. The themes discovered from interviewing the participants relate to the main problem, which is the first of seven themes discussed in this section: the impact of supply chain disruptions.

**Summary of the Findings**

The purpose of this qualitative case study was to understand the various ways the supply chain industry incurs disruption from the lack of enhanced security and the development of potential ideas on how disruptions receive mitigation. This portion of the research had focused on the development of the research questions that needed to be answered to understand the issues of supply chain disruption and develop potential solutions needed to address the issues. The idea of this qualitative research was developed after seeing how the supply chain industry continues to develop and implement new strategies to counteract supply chain disruptions, which are caused by numerous different factors, whether the factors are intentional, unintentional, man-made, or natural. Since this is a recurring issue that has undergone numerous changes and developments with new problems and solutions, most of the questions and answers relied on what was established and discovered from previous research. Seven themes were discovered from the answers provided by the eleven participants after interviewing them for the data collection portion of this research. In the order of most to least occurrences, the themes consisted of the impact of resilient supply chain, lean and change management, quality management, performance measurement, continuous communication, the creation of an understanding environment for employees, and employee empowerment.
By using the coding software in Microsoft Word, the seven themes were identified from the answers provided by the participants in the data collection and interview process. The identification of themes was the use of a thematic analysis, which was utilized after interviewing eleven high-level logistics and supply chain managers. Approval from the Institutional Review Boards (IRB) and consent from the participants after confidentiality insurance was obtained before conducting the interviews. Once the interview process was completed, the identified themes were analyzed and compared to the information established in Section 1 of this research. The common recurring theme was that supply chain organizations must adopt and implement a resilient and lean design with a focus on ensuring flexibility and adaptability to sudden changes, whether it’s the change in the market environment or any sudden disruptions. Disruptions cannot be nullified, which means that organizations must not only develop and implement measures to mitigate supply chain disruption risks but also must develop and implement measures to quickly recover from the impact of supply chain disruptions. Disruptions can occur from various different factors, whether the factors are man-made or natural. Natural disasters are common for catastrophic impact that truly requires a resilient design, as seen in the example with Nissan Motor Company in Japan after the 2011 earthquake (Rezapour et al., 2017). The most obvious and recent example of supply chain disruption is the COVID-19 pandemic, which forced many organizations to change policies and procedures to accommodate the enforced regulations of public safety. The pandemic is proof that supply chain organizations must adopt a flexible and resilient design to both account for sudden disruptions that could halt operations and changes in trends in the market environment caused by customers.

Supply chain organizations face the threat of disruptions on a daily basis, ranging from cyberattacks committed by malicious groups to natural disasters to internal occurrences. The
internal factor is especially dangerous because even though the results and impact on supply chain businesses aren’t as catastrophic as cyberattacks or natural disasters, internal factors are by far the most common factors that contribute to supply chain disruptions, which is why internal factors must be accounted for. Therefore, employee consideration must be incorporated to ensure employees are motivated and committed to the goals of the supply chain organization the employees are working for. Employee empowerment is one such measure that allows for employees to have a voice in the matter when it comes to developing and implementing strategies to adapt to any changes in the supply chain organization, which the strategies alone would bring about changes that would affect the organization as a whole. Furthermore, allowing employees to have a voice in the matter would not only highlight their value and importance to the supply chain organization, especially since employee empowerment also displays a sign of trust of the employee’s level of skills and competence, but also allows for growth from experience regardless of the results of employee empowerment.

Participant 05 had stated that the supply chain is truly like a chain. The concept that one bad link affects everyone else has been an existing concept for decades. This notion is supported by the fact that supply chain organizations have always been significantly affected by disruptions, regardless of the factors contributing to the disruptions and the level of impact the disruptions have on the supply chain industry. Therefore, supply chain organizations must take extra care to implement measures that allows for the organization to be just as fast, dynamic, flexible, and adaptive as the changing trends that define the current market environment while adhering to customer satisfaction and employee consideration. Otherwise, supply chain organizations will fail if unable to keep pace with the current market environment.
Application to Professional Practice

In this qualitative case study, several themes and concepts were explored to understand how supply chain businesses mitigated risks of supply chain disruptions by analyzing any recurring themes from the participants selected for this research. The participants consisted of eleven high-leveled employees and managers of supply chain businesses who had experienced supply chain disruptions and partook in the development and implementation of strategies to mitigate supply chain disruptions. The results of this research from the data collection process can be utilized in many supply chain businesses to prevent risks of disruption, as well as providing a foundation for future research.

Improving General Business Practice. The results of this research can improve general business practices by learning from what was discovered in this research, particularly from the themes discovered during the data collection process. The themes that best apply regarding the improvement of general business practices are continuous communication, employee empowerment, the creation of an understanding environment for employees, and performance measurement. The themes are best suited for improving general business practices because the themes are the results from interviewing the participants during the data collection process, in which the participants shared answers and anecdotes regarding what business practices yielded positive results and should be sustained and what business practices yielded negative results and should be improved upon.

Bourne et al. (2018) proposed communication is important in improving supply chain organizations. Supply chain organizations must facilitate an organizational environment where communication is consistent and frequent in order for every employee to remain informed and prepared for any changes that can be impactful. Furthermore, having strong, effective, and
continuous communication within an organization can be used as a metric for performance measurement, especially since doing so can motivate employees to work their best for their organization (Kamble & Gunasekaran, 2019). The eight of the eleven participants who contributed to the theme of continuous communication stated that their organizations kept a consistent schedule in which all the employees communicate with each other through easily accessible means, such as having daily or weekly team meetings or emails exclusive to specific organizations.

Employee empowerment and the creation of an understanding environment for employees both are critical in an organizational culture for supply chain businesses. Some supply chain businesses created an organizational culture where ideas from employees are welcome, sometimes modified, and then implemented for the purpose of improving supply chain operations. However, other supply chain organizations would create an environment in which employees are very understanding and accepting of any changes to policies and procedures. While both seem like similar concepts, employee empowerment is the concept of giving employees the opportunity to contribute to making business decisions or adjusting the work environment while the creation of an understanding environment is the concept of ensuring employees are receptive to any changes implemented regardless of the positive and negative impacts. Both are equally important because employee engagement has been recognized as a significant driver of salesperson performance in the modern supply chain industry (Meintjes & Hofmeyr, 2018). Therefore, management of supply chain organizations must implement measures to ensure employees are further engaged in their work and are rewarded for doing so, such as public recognition for best performance or promotions (Mangan et al., 2012).
Performance measurement is a required system that is practically implemented in every supply chain business. However, the metrics are what is most important in regard to measuring a supply chain organization’s performance as a business. Several different factors can serve as driving factors for performance measurement, such as impact on customer relationship, competition, and employee motivation (Mangan et al., 2012). Performance measurement also coincides with the previous themes of employee empowerment and engagement because performance measurement systems can be used to assess the effects of employee behavior alongside organizational performance (Laihonen & Pekkola, 2016). Furthermore, performance measurement systems can also lay out a foundation for what constitutes quality performance for a supply chain organization that other organizations can use to analyze, develop, and implement measures into their own organizations to improve business, which also harkens back to what Participant 02 said: “One must “look at how other organizations did their operations, saw what worked and what didn’t, and implement the strategies that worked into our own to improve our processes.”

**Potential Application Strategies.** Supply chain organizations can use the potential strategies derived from the themes discovered in this research from the data collection process. The themes that best apply when adopting strategies to other supply chain organizations to improve processes are quality management, lean and change management, and resilient supply chain designs. The methods implemented vary between different supply chain organizations, but most follow the same focus in changing processes when necessary and adapting to the market environment and customer demand.

Lean and change management is crucial because of the dynamic nature of the market environment that changes at a rapid pace. Since customer demand is the source of changing
trends, supply chain organizations must take measures to develop and implement strategies that enable their organizations to be just as dynamic and flexible. Measures such as continuous improvement, waste elimination, employee empowerment, and performance measurement can be utilized by supply chain organizations to adapt to changes (Po et al., 2019). The purpose of lean and change management is to ensure supply chain organizations can be flexible to adapt to crucial changes in order to remain functional while maintaining high efficiency. Furthermore, measures that are common in lean and change management all have a focus on customer satisfaction, which is integral to all supply chain organizations. Therefore, supply chain organizations must develop and implement strategies that adhere towards meeting customer expectations while maintaining inventory levels at a satisfactory level and continuously improving processes to adapt appropriately.

In addition to implementing measures for supply chain organizations to properly adapt to changes in the market environment, supply chain organizations should also design their supply chains to be resilient. Supply chain disruptions are inevitable, meaning that no supply chain organization will be able to function throughout an organization’s entire lifespan without experience numerous disruptions of various levels. In addition, supply chain disruptions nowadays have increased in likelihood and level of impact, which increases the difficulty of supply chain organizations to withstand disruptions and the impact of disruptions, even in the most robust of supply chain designs. Therefore, supply chain organizations must have resilient designs because of the capabilities in conforming to market demands through proactive identification of anticipated and unanticipated disruption risks (Siegel, 2018). Examples like the Pathfinder-SMS in Pakistan or Nissan Motor Company having access to different providers and manufacturers are the results of a resilient supply chain design, which the former accomplished
the proactive risk identification risk aspect while the latter accomplished the reactive results of a resilient design (Rezapour et al., 2017; Siegel, 2018).

Supply chain organizations must ensure that all the business practices and application strategies discussed in this research contribute towards quality management. With a focus on continuous improvement, customer satisfaction, and waste reduction, quality management is the key to ensuring supply chain organizations remain functional and competitive. While lean and change management have the same focus, quality management focuses on the internal processes of a supply chain organization while lean and change management focuses more on customer satisfaction. Therefore, supply chain organizations must have a strong focus on quality when it comes to developing and implementing strategies that envelops all business practices and application strategies discussed from the themes discovered from the research. Strategies must include employee empowerment and engagement to improve productivity, constant improvement to ensure quality products and services are provided to the customers, continuous and transparent communication of goals and changes within a supply chain organization, and organizational performances are continuously measured to understand what aspects of a supply chain organization needs to be maintained or improved.

**Summary.** The themes discovered in this research had been analyzed in the previous sections because they established concepts from past research and business practices. Since the themes reoccur from both the past literature and research and the answers from the participants for this research, the result is that the themes are essentially requirements for every supply chain business. However, the themes have several differences depending on the supply chain organization, such as what specific strategies are developed and implemented or what kind of environment for the employees is created and encouraged. Therefore, supply chain businesses
must not only implement some form of measures based on the themes found in this research, but also must learn the different types of strategies based on the answers provided by the participants or the anecdotes from past research in order to develop and implement the appropriate strategies, which harkens back to Participant 02’s statement about looking at other organizations and implementing strategies into their own to improve their processes.

**Recommendations for Further Study**

While this research had yielded many helpful results, most of which supported established concepts from previous research, this research is not without gaps that weren’t addressed. One of the biggest concerns of any research is ensuring that the appropriate participants were recruited for the data collection, which was the same concern for this research. While the focus on recruiting participants was looking for high-level supply chain managers and employees, one recommendation is to implement more criteria when recruiting participants to gain better focus for the research. Some of the criteria could have included having a set number of employees from specific entities of the supply chain industry, such as public versus private sector, or producers, warehouses, distribution centers, and retailers. Furthermore, another criteria could’ve included having a set number of participants with different perspectives.

Another recommendation is to implement a quantitative methodology because quantitative research is ideal for using statistical methods to produce quantifiable data results that can be analyzed to determine the relationship between dependent and independent variables (Morgan et al., 2013). The reason the quantitative method was not used for this research was simply because the quantitative methodology did not have enough focus throughout the doctorate program to be used confidently for this research. Having a mix of qualitative and quantitative methodology will be able to produce better results, such as using qualitative research to produce
inductive hypotheses while the quantitative research is used to test the hypotheses with deductive methods.

**Reflections**

Throughout this journey to complete this dissertation, I had noticed numerous developments as a person, student, and employee. While I am not an employee in the supply chain industry and my past employment had very little experience in the supply chain industry, I gained a small understanding of the supply chain industry from the initial research during the writing of Sections 1 and 2 for the dissertation. When I finally reached the data collection phase of the dissertation, I was getting a better picture of the supply chain industry from the first-hand experience of current high-level supply chain employees who participated in my research. Most of the first-hand accounts coincided with what I discovered from the initial research, which further supported the perspective I obtained in the initial research.

However, the worst part of the doctorate’s program was easily the long waiting time for the response of the people and organizations I reached out to in order to find participants for my dissertation. Some of the people and organizations I reached out to did not respond to my recruitment emails. Therefore, I had to utilize other means to reach out to people interested in participating in my research, which thankfully proved to be successful.

**Personal and Professional Growth.** This research had provided for personal and professional growth in many different ways. I had started out very skeptical of my capabilities and determination to complete a doctorate’s program so soon after I had obtained my master’s degree. However, after much support and persuasion to continue my educational momentum, I began my doctorate journey. I found that the doctorate’s journey was similar to what I had been tasked with throughout my master’s program, although with more writing and assignments.
Nevertheless, a new life development occurred that increased my skepticism in my capabilities to complete the doctorate journey. I had finally found a job, which required some extra training and eventually a full schedule. As such, I had to spend less personal time and more on both my job and my doctorate’s program. However, my job had proven to be a blessing in disguise, as I had not only obtained the necessary skills and experiences that coincided with my doctorate’s program, but also the necessary resources for the final stretch of the doctorate’s program: the dissertation.

Despite the hardship of the dissertation phase in which I had to recruit participants to interview for my research, I had learned many ways and resources to make contact with the participants, the questions I needed to develop and answers I needed to obtain for my research, the methods I needed to obtain and maintain the necessary data, and the nuances to the supply chain industry from both past research and the data obtained from the participants for my research. After learning from this research how much the supply industry has changed and continues to develop, I feel that I have gained a much better understanding of the supply chain industry and the strategies needed for supply chain businesses to be flexible and adaptable to remain functional.

**Biblical Perspective.** The business functions explored in this research have applications to the Christian perspective. From the concepts of change management to customer satisfaction to effective management, the Holy Bible contains passages relevant and applicable to the crucial concepts of supply chain management. Furthermore, Keller and Alsdorf (2012) stated that the major principle in life is to serve other people and the world in order to serve God. Keller and Alsdorf’s (2012) principle is applicable to the concept of customer satisfaction in supply chain management because the speed and dynamic nature of the global market had placed a
requirement on the supply chain industry to be just as fast and flexible to remain competitive and functional (Haloukas, 2019). One of the main methods to accomplish this is customer satisfaction, in which supply chain businesses must design their supply chain and implement policies and procedures to best serve the customer. Therefore, the concept of serving customers to the best of the supply chain organization’s abilities coincide with the concept of serving God by serving the people and the world (Keller & Alsdorf, 2012).

While the concept of effective management was not thoroughly explored as a theme in this section of the research, effective management is a requirement in supply chain businesses, nonetheless. All the themes explored in this research make for effective strategies in supply chain businesses, but as Participant 01 stated, “the mitigation strategies themselves aren’t universal due to different circumstances and factors.” As such, management must develop and implement the appropriate strategies and adapt as necessary, which is the core concept of change management. The story of Joseph in the Book of Genesis involves a moment that applies to the concept of change management and effective management, specifically the role of the Pharaoh (The Holy Bible, 1984). In the story, the Pharaoh had been haunted by two nightmares every night, and none of his professional interpreters and scholars could make sense of what his nightmares mean and why always the same two nightmares. After being told of Joseph’s gift of dream interpretation, Pharaoh accepted Joseph’s aid and learned of an upcoming boon and bane: seven years of abundance followed by seven years of famine. With Joseph’s wisdom in preparing for the famine, the Pharaoh had named Joseph the second-in-command of Egypt despite Joseph being of a different race and faith (The Holy Bible, 1984). This story exemplifies how management not only needs to be in charge of developing the proper strategies, but also be receptive to change and adapt as required.
In addition to the story of Joseph, the New Testament of the Holy Bible is another example of change management, especially with the story of Jesus Christ. The story of Jesus was all about changing the practices of the Old Testament, which his disciples were initially surprised by every time Jesus had provided a new practice but had slowly accepted, especially when the disciples saw the positive results of Jesus’s new practices (The Holy Bible, 1984). One of the biggest changes was the ending of animal sacrifices when Jesus himself had made the ultimate sacrifice for humanity’s sins. The practice of changing and adapting while keeping the methods that yielded the most positive results is also important in supply chain businesses, as emphasized by Participant 02’s anecdote of analyzing the operations of other supply chain organizations, utilizing the strategies that were most beneficial, and modifying the strategies that fits their own organizational culture before implementing the developed strategies to improve processes and business. The concept of lean and change management in supply chain businesses has a significant biblical application because the foundation of the New Testament of The Holy Bible (1984) revolves around changing and adapting the practices established in the Old Testament for a long period of time. Therefore, the biblical application also applies to the real world because the real world is constantly changing and thus supply chain organizations must also change and adapt in order to maintain the goal of customer service.

Summary. I had come a long way throughout this Doctorate in Business Administration (DBA) program. From a simple graduate of an online master’s program to a student in the dissertation phase of an online doctorate program, I have learned so much from this experience. I learned the numerous nuances to how a supply chain business functions, developed upon what I had learned from my master’s program, refined my knowledge and interpretation of established research, and understood and addressed any personal shortcomings. While I did have several
obstacles in terms of researching for the initial phase and the data collection phase for the dissertation, I had managed to focus on mitigating the major personal obstacles that would have hindered this qualitative case study research, such as personal biases. Furthermore, thanks to the data collection process in which I interviewed the participants for this research, I gained better knowledge about the condition and experiences of the supply chain industry.

**Summary of Section 3**

In this qualitative case study, the strategies developed and implemented by supply chain organizations were explored using the experience of eleven high-level supply chain employees and managers. From the results of the research, supply chain organizations must take extra care to develop and implement strategies that are flexible and adaptable to the dynamic nature of the market environment, encompass consideration towards employees in addition to customer satisfaction, design the supply chain to be resilient in the event of a supply chain disruption, create a measurement system based on the needed strategies to determine the aspects of the supply chain organization to be maintained or improved upon, and set the standards to strive for in order to ensure quality products and services.
References


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https://doi.org/10.17169/fqs-19.3.3099.


Appendix A: Questionnaire

1. What were the effects on your organization as a result of disruptions in the supply chain?

2. What strategies did your organization implement to improve supply chain security? If any, did those strategies also involve mitigating the risks and effects of supply chain disruptions?

3. What was the response from the employees to those strategies?

4. What obstacles, if any, did you encounter in developing and implementing the strategies to mitigate supply chain disruption risks and how were they addressed?

5. How do the recent strategies to mitigate supply chain disruption risks compare to the previous strategies?

6. How were the strategies properly communicated throughout the organization in order to properly enhance supply chain security and mitigate disruptions?

7. What modifications did you apply to any strategies to improve the effectiveness in enhancing supply chain security and mitigating disruptions?

8. How were the implemented strategies assessed in their effectiveness in enhancing supply chain security and mitigating disruptions?

9. What additional information would you like to share regarding strategies to enhance supply chain security and mitigate disruptions?
Appendix B: Questionnaire Protocol

Email Introduction to the Participants

Hello, my name is John Kim, a student at Liberty University pursuing a doctoral degree in Business Administration with a concentration on logistics and supply chain management. Thank you for accepting to participate in this study. I am conducting a qualitative case study to understand supply chain security and discover potential measures and strategies to reduce supply chain disruptions in the west coast ports. Since our interaction will only be through email, there is no time limit and the questionnaire is formatted to be open-ended, thus allowing you to be as detailed with your answers as possible from your perspective. If there are information that must not be disclosed for the sake of your confidentiality and your organization’s security, I will ensure that follow-up contact is conducted to allow for the answers to be adjusted. Please feel free to let me know if you don’t understand a question or if you want further clarification.

After the Questionnaire Data Collection

I will let the participants know that they will receive a copy of the compiled data from their answers formatted for the qualitative research. The participants must review the copy, provide feedback on any inaccuracies, give consent to the answers and feedback provided, and return it. Afterwards, thank the participants for their time partaking in the study and remind them that they are free to contact me again if they have any questions or concerns.