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Strategies for Improving the Success Rates of Lean Six Sigma Projects

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This is to certify that the doctoral study by

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2020

Abstract

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by

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MS, National Louis University, 2001

BA, Eastern Illinois University 1982

Doctoral Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

Ineffective Lean Six Sigma (LSS) project strategies can lead to excessive Lean Six Sigma (LSS) project costs. Manufacturing business leaders who fail to mitigate LSS project costs expose the LSS project to failure. Grounded in the theory of constraints, the purpose of this qualitative single case study was to explore successful strategies LSS project leaders use to mitigate project costs in manufacturing. The participants comprised 16 aerospace manufacturing business leaders located in the southeast and northwest regions of the United States, who successfully implemented strategies to mitigate LSS project costs. Data were collected from semistructured interviews, a focus group, and a questionnaire. Thematic analysis was used to analyze the data, 4 themes emerged: preparation, objectives, robust training, and collaboration. A key recommendation for business leaders is that involving an LSS certified expert is critical to LSS project leadership to mitigate project costs. The implications for positive social change include the potential for funding to social enterprises that reduce poverty, unemployment, and homelessness within the communities in which they operate.

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Dedication

I dedicate this study to my mother, Bernice, who instilled in me the importance of an education, and my siblings Toni, Marvin, Mark, Indiana, Larry, James, and Betty.

Acknowledgments

Michelle Obama stated that life should not be about how much money you make; life should be about making a difference in the lives of others. Dr. Linda Hansken's contributions to my success on this program have made a difference in my personal and professional life. Dr. Lisa Cave, Darrel Larson, Gary Brennan, Dan Guzman, Arthelas (Jean) Hicks, William Osborne, and Dr. Karen Walker have also given their support. I plan to follow their examples in service of making a difference in the lives of others.

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Section 1: Foundation of the Study

Global manufacturing businesses require new strategic operations that offer an edge over their competitors and increase profitability (Alvarez, Aldas, & Reyes, 2017; Antony & Gupta, 2019). The implementation of continuous improvement strategies like Lean Six Sigma (LSS) help business leaders achieve quality products, increased production capacity, and profits (Alexander, Antony, & Rodgers, 2019; Antony et al., 2019; Barnabè & Giorgino, 2017). Although some manufacturing business leaders have experienced cost savings with the successful implementation of LSS, 70% of LSS projects fail and can significantly increase project implementation costs for manufacturing businesses (Antony et al., 2019; McLean, Antony, & Dahlgaard, 2017; Sony, Naik, & Therisa, 2019). McLean et al. (2017) indicated that there is limited research on LSS failures. Using a qualitative case study, I explored the successful LSS strategies business leaders use to mitigate increased project costs.

Background of the Problem

Business leaders who employ successful LSS projects can identify, examine, and implement improvements to processes and remove defects to achieve cost savings for a competitive advantage (Albliwi, Antony, Abdul halim Lim, & van der Wiele, 2014; Denning, 2011). Albliwi et al. (2014) identified 19 case studies and showed 50 LSS benefits arising from the mitigation of project costs. The top 10 benefits identified were (a) increased profits and financial savings, (b) customer satisfaction, (c) production capacity, (d) reduced costs, (e) improved cycle time, (f) fewer defects, (g) low inventory,

(h) shorter machine breakdown times, (i) improved key performance metrics, and (j) improved quality.

Sony et al. (2019) showed that even though manufacturing business leaders experience benefits from LSS projects, the majority of LSS project implementations are not successful. Albliwi et al. (2014) found that selecting the wrong LSS tools inhibited successful outcomes and could result in increased costs. Researchers have indicated that implementing LSS involves numerous expenses. The expenses include travel, consultants, and specialized training for subject matter experts, such as Black Belts, Green Belts, and Yellow Belts (Amin & Karim, 2013) that can cost as much as $2,000 a course per employee (American Society for Quality, 2018). Albliwi et al. (2014) and Amin and Karim (2013) noted that researchers should shift from looking at the benefits of using specific LSS tools toward gaining an understanding about how to select LSS tools to mitigate project costs.

Problem Statement

Excessive LSS operating costs can place manufacturing businesses at a competitive disadvantage (Albliwi, Antony, & Abdul halim Lim, 2015). Antony et al. (2019) and Sony et al. (2019) indicated that although some manufacturing businesses achieve cost-saving benefits through successful LSS projects, 70% of LSS projects fail and can significantly increase project implementation costs for manufacturing businesses. The general business problem is that excessive LSS project costs have negative effects on manufacturing leaders' profitability. The specific business problem is that some LSS project leaders lack strategies to mitigate project costs.

Purpose Statement

The purpose of this qualitative single case study was to explore the successful strategies that LSS project leaders use to mitigate project costs within manufacturing. The targeted population were 17 LSS project leaders located at a single manufacturing business in the southeast and northwest regions of the United States who successfully implemented strategies to mitigate project costs. The findings from this study might provide project leaders with strategies that help to reduce project costs. Leaders of organizations who reduce project costs may contribute to social change by contributing funds to social enterprises, and increased funding for social enterprises could reduce poverty, unemployment, and homelessness within the community.

Nature of the Study

Researchers can use qualitative, quantitative, or mixed methods to conduct research studies (Saunders, Lewis, & Thornhill, 2015). Researchers use a qualitative methodology to gain knowledge by exploring the thoughts and opinions of people who have experience with the phenomenon (Park & Park, 2016; Saunders et al., 2015; Yin, 2018). I chose the qualitative methodology because the qualitative method is a rational approach to obtaining findings for addressing the research questions. Researchers typically use the quantitative methodology to examine relationships among variables using numeric measures and probability sampling to ensure the findings are generalizable (Saunders et al., 2015). Researchers use the mixed method to integrate both qualitative and quantitative research methods to enrich data collection and analysis and to address any weaknesses of the methods when used singularly (Saunders et al., 2015). I did not

choose a quantitative or mixed method because I did not conduct numerical analysis or test hypotheses. Therefore, quantitative and mixed methods were not appropriate to explore LSS project leaders' strategies to mitigate project costs.

A qualitative case study research design was appropriate to obtain insights into research questions that address *what*, *how*, or *why* with regard to a phenomenon (Yin, 2018). Employing a case study technique also enables a researcher to explore a phenomenon within a real-world context and gain insights regarding the phenomenon from individuals with knowledge of the phenomenon (Yin, 2018). Through a qualitative case study design, I gained insights from the experiences of aerospace manufacturing LSS project leaders on the successful strategies they use to mitigate project costs.

According to Saunders et al. (2015), ethnographic, phenomenological, and case study designs support qualitative research. The focus of ethnographical researchers is exploring the interaction of groups within a culture (Hamilton & Finley, 2019; Saunders et al., 2015). Ethnographic research did not meet the needs of this study because the primary focus was on the strategies that LSS manufacturing business leaders use to mitigate project costs. Phenomenological researchers focus on groups of people and explore the personal meanings of their lived experiences (Saunders et al., 2015), which also did not meet the needs of this study. Yin (2018) indicated that a case study technique enables a researcher to explore a phenomenon within a real-world setting to obtain insights from individuals with knowledge of the phenomenon. A single case study versus a multiple case study is sufficient when the case is common to an everyday scenario and could provide information on the phenomenon under study (Yin, 2018). Therefore, a

qualitative case study was appropriate for exploring the successful strategies that LSS project leaders within the manufacturing industry use to reduce LSS project costs.

Research Question

What successful strategies do LSS project leaders use to mitigate LSS project costs?

Interview Questions

1. What successful strategies did you use to mitigate project costs?
2. Based on your experience, what were the key factors, processes, and tools that contributed to the successful implementation of strategies to mitigate LSS project costs?
3. What key obstacles did you face during the implementation of strategies to reduce LSS project costs?
4. How did you overcome these key obstacles during the implementation of strategies to reduce project costs?
5. What additional information can you share about the successful implementation of strategies you and your organization used to reduce LSS project costs?

Conceptual Framework

The conceptual framework underpinning this study was the theory of constraints (see Figure 1). Goldratt developed the theory of constraints during the 1970s and introduced the theory in the book *The Goal* in 1984 (Goldratt, 1984, 1988; Vendemia, 2018). Goldratt (1984) highlighted organizational processes that align resources used to

generate inputs for transformation into products and services for sale (Sreedharan & Raju, 2016; Trojanowska & Dostatni, 2017). Manufacturing business leaders encounter multiple challenges within their markets. The challenges these leaders encounter stem from the need to produce products that consumers want with the quality and value to keep pace with changing demands (Goldratt, 1984; Trojanowska & Dostatni, 2017).

Constraints, which are inherent in all processes, are barriers to achieving desired outcomes or the level of performance that leads to financial gains and creates issues for improvement methodologies such as LSS (Goldratt, 1984; Trojanowska & Dostatni, 2017). Manufacturing business leaders use the theory of constraints to focus on the weakest points within processes and then implement strategies to address these constraints (Goldratt, 1984; Trojanowska & Dostatni, 2017). The cyclical structure of the theory allows business leaders to (a) identify, (b) exploit, (c) subordinate, (d) elevate, and (e) repeat the process to eliminate constraints within a process at the different phases identified in Figure 1.

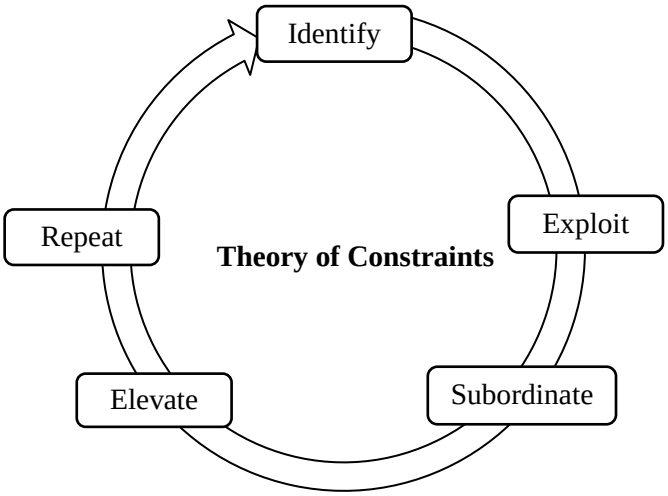

Figure 1. The figure of the theory of constraints. Reprinted from *Lean Production: Theory of Constraints*, by Vorne Industries, 2016. Copyright 2011–2016 by Vorne Industries Inc. Adapted with permission.

Figure 1 provides a visual depiction of the theory of constraints. The circular arrow indicates the cyclical and repeatable nature of the process. The theory of constraints was the conceptual framework for my study because of its foundational use in the application of strategies and methodologies such as LSS. The theory of constraints provides a repeatable process that LSS leaders use to identify and take advantage of constraints that would otherwise impede the successful completion of projects. The theory of constraints also serves as an anchor that provides a prescription for understanding which LSS project strategies and tools to use during the phases of an LSS project.

Operational Definitions

Lean: A strategic approach that includes a collection of tools such as value-stream mapping and define, measure, analyze, improve, and control (DMAIC), with a focus on continuous improvement in production processes (Christensen & Rymaszewska, 2016).

Lean Six Sigma (LSS): A practice that encompasses Lean and Six Sigma, as well as a combination of tools with a focus on continuous improvement production processes (Antony, Snee, & Hoerl, 2017).

Offshoring: The relocation of U.S. production activities, typically to foreign countries to drive efficiency and achieve cost savings through lower production costs (Johansson & Olhager, 2018; Stentoft, Mikkelsen, Jensen, & Rajkumar, 2018).

Reshoring: The relocation of production activities that were previously offshored to other countries back to the United States (Gobble & Holden, 2012).

Assumptions, Limitations, and Delimitations

Assumptions are perceptions accepted as true without proof (Morrow & Nkwake, 2016). I conducted this study under the following assumptions concerning data collection and analysis. One assumption was that a qualitative study was the most appropriate method for the study. Another assumption was that the participants responded to the interview questions truthfully and that their responses were sufficient to answer the research questions.

Limitations are constraints within research that are beyond the control of the researchers (Brutus, Aguinis, & Wassmer, 2013). One limitation was that I served as the instrument for this qualitative case study. I also had time constraints under which to conduct the study. My employment in manufacturing presented no bias, as the use of member checking eliminated researcher bias. The findings may not be generalizable due to the small sample size. In addition, the potential for undue influence did not exist, as participants for this case study were volunteers; however, comments made by participants

in the focus group might have influenced the responses of other participants. There are no other known risks indicated in this research.

Delimitations are boundaries or a scope determined by a researcher but not addressed in a study (Newman, Hitchcock, & Newman, 2015). One delimitation was that my study was a single source case study conducted within an aerospace business. Another delimitation was that only LSS leaders working in the aerospace industry participated. The participants were limited to a single aerospace business in the southeastern United States. The experiences of other leaders working in nonaerospace businesses may differ. The findings identified outside of the participating aerospace business in this case study may not be generalizable to other geographical locations, all aerospace businesses, and other industries.

Significance of the Study

Contribution to Business Practice

Business leaders within the manufacturing industry may be able to use the findings of this study to contribute to understanding how leaders of LSS projects develop and use effective strategies that lead to the mitigation of LSS project costs. LSS is significant to achieving successful outcomes that result in the mitigation of project costs and organizational profitability (Yadav & Desai, 2016); however, leaders typically lack effective strategies for implementation, which results in project failure and increasing costs (Albliwi et al., 2015). The findings from this study could provide LSS leaders with logical strategies to reduce LSS project costs and to improve performance in manufacturing organizations.

Implications for Social Change

Manufacturing business leaders might use the cost savings from LSS projects to contribute to social change by contributing funds to social enterprises that provide jobs to people within communities. Social enterprises can enable positive social change for people by focusing on the reduction of poverty, unemployment, and homelessness (Powell, Gillett, & Doherty, 2019). According to Kilmer and McLeigh (2019), individuals and communities within the United States are facing various challenges due to the lack of opportunities that impact their quality of life and welfare.

A Review of the Professional and Academic Literature

The purpose of this qualitative single case study was to explore the successful strategies that LSS project leaders use to mitigate project costs within manufacturing. The foundation of the study was the theory of constraints, which served as a model for applying LSS projects and tools. The topics within the literature review highlight relevant research to this study, such as continuous improvement methodologies and the evolution of LSS.

In this review, I provided a critical reflection of 168 peer-reviewed and practitioner articles (see Table 1) in an in-depth academic inquiry into the evolution of continuous improvement methodologies, the evolution of LSS, and the exploration of some associated tools. The strategy I used to identify the literature applicable to the study included reviewing EBSCO (Academic Search Premier and Business Search Premier) databases, full-text databases such as Business Source Complete, academic journals, ProQuest Dissertations and Theses, and Google and Google Scholar search engines.

Searches consisted of various terms, acronyms, and phrases such as *aerospace projects, Lean Six Sigma tools, theory of constraints, competitive advantage, Lean manufacturing, continuous improvement, project management, Deming, Ohno,* and a commonly used abbreviation for Lean Six Sigma: *LSS*. The literature review includes a comparison of theoretical concepts to the theory of constraints and continuous improvement methodologies to LSS, market competition, early continuous improvement strategies, and the evolution of LSS.

Table 1

Summary of Peer-Reviewed Articles

	Within 5 years	More than 5 years	Total	% Peer-reviewed
Journals				
Peer-reviewed	105	58	163	0.79
Non-peer reviewed	17	26	43	
Total	122	84	206	
Books/Other	7	1		

Theory of Constraints

I selected the theory of constraints as the conceptual framework for this study for several reasons, particularly because business leaders have found the theory of constraints effective in helping them achieve their goals when used in conjunction with LSS tools. According to Kuruvilla (2017) and Trojanowska and Dostatni (2017), researchers use the theory of constraints to help identify, leverage, or remove constraints within processes. The leveraging or removal of constraints contributes to the achievement of business goals and objectives. Constraints are obstructions to the business goal of making profits, and

profits incorporate shareholder value or discounted cash flow (Goldratt, 1988; Spasojevic Brkic & Tomic, 2016).

The theory of constraints is generalizable to various industries, disciplines, and managerial domains. Manufacturing business leaders rely on the theory of constraints when exploring cause and effect relationships that are critical to achieving any continuous improvement using LSS (Bauer, Vargas, Sellitto, Souza, & Vaccaro, 2019; Kuruvilla, 2017). Researchers use the theory of constraints to address research questions because all business leaders face constraints or limits that interfere with operational performance measures, also known as system process outputs, throughput, or productivity (Kuruvilla, 2017; Trojanowska & Dostatni, 2017). Introduced by Goldratt in 1988, the theory of constraints is a management methodology that manufacturing business leaders use to explore how to take advantage of limitations, address business objectives, and understand the circumstances needed to achieve those objectives. Goldratt identified the objectives of the theory as customer satisfaction, quality, and competitive advantage (see also Muraliraj, Zailani, Kuppusamy, & Santha, 2018).

Significant changes in the support of continuous improvement occurred during the 1970s when Goldratt established the theory of constraints and helped business leaders explore how to take advantage of limitations identified as constraints (Goldratt, 1988; Kuruvilla, 2017; Trojanowska & Dostatni, 2017). Trojanowska and Dostatni (2017) noted that business leaders have used the theory of constraints across multiple businesses since the mid-1980s. Business leaders use the theory of constraints to address fundamental questions for continuous improvement, such as what to change, what the

change will be, and how the change should occur (Kuruvilla, 2017; Trojanowska & Dostatni, 2017). Additionally, business leaders incorporate the theory of constraints to focus on weaknesses within system processes via the five focusing steps—(a) identify, (b) exploit, (c) subordinate, (d) elevate, and (e) repeat—in conjunction with other tools and methodologies such as LSS (Ioana, 2018; Pacheco, 2014). Business leaders rely on assumptions such as using speed, volume, and existing processes to achieve output that will lead to success when using the theory of constraints (Trojanowska & Dostatni, 2017). Manufacturing business leaders can achieve continuous improvement by recognizing and analyzing obstacles and resolving issues through a combined application of LSS and the theory of constraints, when properly integrated (Ioana, 2018; Pacheco, 2014).

Researchers have explored several other theories and methodologies that they can use to complement or compete with the theory of constraints and LSS. Researchers can use each complementary theory and methodology to help optimize results from LSS in mitigating project costs and gaining a competitive advantage (Cox & Ulmer, 2015; Dixon & Hart, 2010; Hameed, 2009; House, 1996; Ioana, 2018; Magombo-Bwanali, 2019; McLean & Antony, 2014; Porter, 1980; Pretorius, 2014; Sigalas, 2015). Competitive advantage theory, path-goal theory, and contingency theory are examples of complementary theories to the theory of constraints. Competing theories to the theory of constraints are internalization theory and the theory of even flow. Complementary methodologies to LSS are the new mental model and project management. Competing

methodologies to LSS are a balanced scorecard, ISO 9001, plan–do–check–act (PDCA), and agile.

Complementary Theories

Competitive advantage theory. Business leaders use competitive advantage theory to complement the theory of constraints as a model for obtaining a competitive edge. Beaudreau (2016) and Sigalas (2015) indicated that manufacturing business leaders use competitive advantage theory to focus on differentiating their products and services from competitors' products and services to provide customers with products and services at a low cost or by offering unique products and services at relatively comparable costs. Hameed (2009) and Nelligan, Cameron, and Mackinnon, and Vance (2016) indicated that competitive advantage theory works through a business's value chain, and each link of the chain encompasses activities that add value.

Porter (1980) noted three approaches to developing a successful strategy and referred to them as generic strategies: the overall cost of leadership, differentiation, and focus. The overall cost of leadership relates to business leaders' ability to maintain control over costs to achieve the largest return on investment. Differentiation refers to business leaders' ability to manufacture unique products or services that help achieve an advantage over competitors. Porter (1980) posited that differentiation could lead to products or services that become preferable and inspire customer loyalty. Focus refers to business leaders' ability to serve a narrow and targeted market with products and services. The cost of leadership and differentiation stems from an industry perspective.

Focus stems from a target market perspective. Porter indicated that business leaders can use target markets as a defense from competitors or limit vulnerability to competitors.

Pretorius (2014) used the theory of constraints to highlight the links or activities associated with the value chain from the competitive advantage theory that exists between processes and functions to develop products and services or throughput. Constraints affect throughput in two categories: nonphysical and physical. Pretorius indicated that nonphysical constraints are a turndown in market demand or communication issues within the supply chain. Physical constraints lead to a lack of resources or materials to develop a product or service to throughput. Business leaders' ability to focus on efficient and increased throughput or productivity to meet demands in the market enables profits to increase. Cox and Ulmer (2015) noted that using continuous improvements also encompasses creating products and services that consumers want and at a low cost, which is critical to obtaining a competitive advantage.

Business leaders use competitive advantage theory to support the theory of constraints indirectly. According to Hameed (2009), Porter (1980), Pretorius (2014), and Sigalas (2015), business leaders use competitive advantage theory for gaining market share and for appealing to the customer base from both an industry and a lower level perspective. Business leaders can focus on creating products and services that set them apart from other businesses in the market and manage internal costs to produce the product.

Path-goal theory. Dixon and Hart (2010) and Malik (2013) indicated that the path-goal theory is also complementary to the theory of constraints in promoting

leadership styles that address change and the exploitation of constraints. House (1996) developed the path-goal theory, which encompasses four styles of leadership. House, as well as Magombo-Bwanali (2019), indicated that the four styles of leadership are directive, supportive, participative, and achievement-oriented. Directive leadership involves leadership communication on expectations, goals when work will finish, and rules to follow (House, 1996; Magombo-Bwanali, 2019; Nor Amin, Wuen, & Ismail, 2017). Supportive leadership involves being approachable, showing interest in the concerns of work-group needs, and expressing a desire to improve work conditions and make the environment friendlier (House, 1996; Magombo-Bwanali, 2019; Nor Amin et al., 2017). Participative leadership involves engaging employees to obtain ideas and considering those ideas in decision-making (House, 1996; Magombo-Bwanali, 2019; Nor Amin et al., 2017). Achievement-oriented leadership involves challenging employees to achieve high-level performance and conveys the assurance that employees will achieve high-level performance objectives (House, 1996; Magombo-Bwanali, 2019; Nor Amin et al., 2017). In addition, House (1996) and Magombo-Bwanali (2019) indicated that researchers use path-goal theory to make a connection between leaders and subordinates and to guide leaders on the appropriate style to use depending on the situation or task.

Albliwi et al. (2014), Albliwi et al. (2015), Laureani and Antony (2016), and McLean and Antony (2014) noted that leadership is a critical success factor to LSS projects and to the selection of correct LSS tools. Dixon and Hart (2010) observed that leadership styles are significant because the U.S. workforce is likely to increase in diversity, given the increases in immigrant labor from Asia and Latin America. Dixon

and Hart, as well as Ozgen, Nijkamp, and Poot (2017), indicated that cultural differences, if managed well, can be a source of learning and growth for work groups. Though Guillaume, Dawson, Otaye, Woods, and West (2017) indicated that there are negative outcomes to increased diversity in work groups, such as low morale, diversity in work groups can also have benefits, such as the increased capacity for innovation and efficiency through the exploitation of constraints (Dixon & Hart, 2010; Guillaume et al., 2017; Ozgen et al., 2017).

Manufacturing business leaders rely on path-goal theory to apply the various leadership styles that promote a productive workforce. Business leaders use leadership styles in managing diversity within the workforce. Business leaders also use leadership styles to achieve goals like mitigating project costs and introducing a reward system that encourages the workforce (Dixon & Hart, 2010).

Contingency theory. Contingency theory is a complementary theory to the theory of constraints. According to Sauser, Reilly, and Shenhar (2009), the approach of using one tool or a set of tools consistently for every project is not appropriate to achieve successful project outcomes. Projects require a variety of tools based on the unique circumstances and project objectives of each project. Prester, Buchmeister, and Palčič (2018) and Sauser et al. noted that business leaders use contingency theory in decision making and in selecting unique tools and practices that address the current situation, as opposed to a general selection of tools. Hanisch and Wald (2012) and Williams, Ashill, and Naumann (2016) contended that business leaders use contingency theory to support leadership decision making and the achievement of competitive advantage using diverse

strategies that fit or are applicable to the situation. Hanisch and Wald (2012) and Mullaly and Thomas (2009) indicated that business leaders can achieve success in obtaining a competitive advantage by using the correct tools and processes as well as obtain insights into management style practices or root causes in conjunction with project failures that can be technical or managerial. Business leaders use a combination of contingency theory and LSS to examine the conceptual fit of project characteristics and project management to obtain greater insights into the reasons projects fail beyond the critical success and failure factors currently noted in the literature.

I discussed competitive advantage theory, path-goal theory, and contingency theory as complementary theories to the theory of constraints that help business leaders mitigate project costs (Cox & Ulmer, 2015; Dixon & Hart, 2010; Hameed, 2009; Hanisch & Wald, 2012; House, 1996; Magombo-Bwanali, 2019; Malik, 2013; Mullaly & Thomas, 2009; Porter, 1980; Pretorius, 2014; Sauser et al., 2009; Sigalas, 2015). Business leaders use competitive advantage theory indirectly with the theory of constraints to achieve a return on investment by offering products and services that are unique, available at a low cost, and directed at a specific or targeted market (Cox & Ulmer, 2015). According to Dixon and Hart (2010), House (1996), Magombo-Bwanali (2019), and Malik (2013), leaders use the path-goal theory to mitigate project costs by taking advantage of four leadership styles (a) directive, (b) supportive, (c) participative, and (d) achievement-oriented. Directive leadership refers to a leadership communication style with regard to goals; support leadership requires a leadership focus on the well-being of employees; participative leadership refers to leaders' ability to engage employees and obtain their

ideas and feedback; and achievement-oriented leadership refers to challenging employees to achieve high levels of performance (Dixon & Hart, 2010; House, 1996; Magombo-Bwanali, 2019; Malik, 2013; Nor Amin et al., 2017). Hanisch and Wald (2012), Sauser et al. (2009), and Mullaly and Thomas (2009) indicated that business leaders use contingency theory to help them identify the correct tools and practices to use and to conduct root-cause analysis on project failures.

Competing Theories

Internalization theory. Manufacturing business leaders use internalization theory to focus on location decisions for production and operations to determine cost reductions. According to Buckley and Tian (2017), business leaders use internalization theory to explore opportunities to take advantage of emerging or lower cost markets to reduce costs. Business leaders make location decisions that can be domestic and international. Differences in culture and geographical location contain risks of increased costs due to the degree of monitoring and enforcement of operations or production oversight needed by the primary business leader (Buckley, 2017; Buckley & Tian, 2017). Cost increases can also occur because of improved economic conditions experienced in an emerging or low-cost market. In addition, unscrupulous behavior by suppliers could drive increases in production and operation costs (Buckley & Tian, 2017). Business leaders who use internalization theory do not highlight or focus on improving existing processes and operations. Within the theory of constraints, business leaders focus on cost-saving objectives using existing internal production and operations processes and an

organization leader's ability to take advantage of constraints that impede performance and profits (Kuruvilla, 2017; Trojanowska & Dostatni, 2017).

Theory of even flow. According to Boer et al. (2015) and Schmenner (2015), when using the theory of even flow, only two factors are necessary for productivity variability reduction and the total time it takes to produce a product from start to finish. This model of productivity, also known as the theory of even flow, refers to the flow through the production process (Boer et al., 2015; Schmenner, 2015). The achievement of variation reduction and the throughput time frame help to drive efficiency and remove non-value-added activities from production. Although business leaders use the theory of even flow and the theory of constraints to focus on speed and processes to achieve improved production, the theory of even flow does not help business leaders address constraints within processes. Trojanowska and Dostatni (2017) indicated that constraints are inhibitors to production that exist in all processes, and business leaders use the theory of constraints to address them.

I discussed internalization theory and the theory of even flow as competing theories to the theory of constraints. Although these theories are complementary to the theory of constraints, none of them focus on constraints. Business leaders use internalization theory to make location use decisions for production and operations to achieve cost savings. Business leaders use internalization theory to make location decisions based on lower cost markets (domestic or foreign) as opposed to the theory of constraints, which business leaders use to highlight issues in existing production practices and processes to achieve efficiency and costs savings. Although business leaders use the

theory of even flow to evaluate existing processes for improvement, the theory does not help business leaders address constraints that are inherent in all processes.

Lean Six Sigma Methodologies

Lean and Six Sigma. Muraliraj et al. (2018) observed that a misconception about the tools associated with Lean and Six Sigma is that the methodologies and associated tools conflict with one another. However, Gopikumar, Nair, Chakraborty, and Antony (2018), Muraliraj et al., Rodgers, Antony, He, Cudney, and Laux (2019) as well as Sreedharan, Nair, Chakraborty, and Antony (2018), and, Sunder M (2016) suggested that Lean and Six Sigma methodologies complement each other and enable business leaders to achieve faster delivery of quality products to consumers. Albliwi et al. (2014), Albliwi et al. (2015), Antony et al. (2017), and Sony et al. (2019) noted that the manufacturing business leaders who combine Lean and Six Sigma tools achieve the greatest benefits. Almansur, Sukardi, and Machfud (2017), Muraliraj et al. (2018), and Sreedharan et al. (2018) asserted that manufacturing business leaders who use Lean can improve processes through waste elimination, thereby improving the speed of delivery to consumers. The combination of Lean and Six Sigma tools forms a powerful collection of tools and processes (Muraliraj et al., 2018; Sony et al., 2019; Sreedharan & Raju, 2016; Yadav & Desai, 2016).

Examples of Lean and Six Sigma tools. Breyfogle (2015) noted that business leaders use LSS tools to conduct data analysis to resolve problems and make improvements. Though LSS tools have been around for many years, the application of the tools can vary. Breyfogle (2015) and Chaneski (2016) explored how business leaders

have applied five LSS tools to identify issues at the source or root causes (a) five whys, (b) fishbone diagram, (c) histogram, (d) regression analysis, and (e) run chart or time series.

Manufacturing business leaders use the five whys, a form of brainstorming, to identify the cause-and-effect relationships of problems (Breyfogle, 2015; Chaneski, 2016). The LSS project team members identify why a problem occurred and how to document the issue. If the initial response to the question of why the problem occurred does not address the cause, the process of questioning continues until the team members identify an acceptable response for the root cause (Breyfogle, 2015; Chaneski, 2016). When manufacturing business leaders desire specific information on root causes, a more structured approach is necessary. Breyfogle (2015) and Miller, Hill, and Miller (2016) indicated that business leaders use the fishbone diagram (also referred to as the Ishikawa diagram) to obtain root cause categories of information, methods, people, machines, equipment, materials, environment, and management. The fishbone diagram resembles the skeleton of a fish (Breyfogle, 2015; Miller et al., 2016; Shinde, Ahirrao, & Prasad, 2018). The LSS team members align the problem at the head and then connect the root causes to the bone structure identified in the specific categories. When manufacturing business leaders seek to gain insights into processes as they relate to the expectations of customers, they choose the histogram diagram (Breyfogle, 2015; Chaneski, 2016). The diagram is useful when analyzing information to ensure consistency in meeting customer expectations. To understand relationships between input and output processes, manufacturing business leaders choose regression analysis. Although there are issues

inherent to regression analysis as it relates to root causes, Breyfogle (2015) indicated that the analysis can provide information on how to incorporate inputs to achieve desired outputs. Lastly, business leaders may choose the run chart or time series to identify and understand trends.

According to Chaneski (2016), Phruksaphanrat (2019), and Thomas, Francis, Fisher, and Byard (2016), manufacturing business leaders use the Six Sigma tools to focus on reducing variations in processes and business problems. Business leaders who use Six Sigma tools correctly can forecast probable outcomes of a process. Researchers explained that the basic premise for using Six Sigma tools such as DMAIC is to reduce variations, which, in turn, will improve an entire process (Chaneski, 2016; Phruksaphanrat, 2019; Sreedharan & Sunder, 2018; Thomas et al., 2016). Each letter within the term DMAIC represents a specific purpose or phase. Define is the first phase of DMAIC, wherein a manufacturer considers the customer base and identifies specific problems related to the customers (Chaneski, 2016; Thomas et al., 2016). In the define phase, the manufacturer identifies the conditions for output using the existing process. The measure phase is the second phase and involves collecting information for the manufacturer to examinee processes and provides information on the characteristics of those conditions for output. In the analyze phase, business leaders investigate the data from the prior phase to provide a better understanding of the root causes of defects or other issues such as flow time, which is the time it takes to transform raw materials into a salable final product. Thomas et al. indicated that the improve phase begins after the analyze phase is complete and an understanding of the root causes of problems exists;

then design changes occur to resolve the problem. The improved process involves measuring the result using the measured phase. Control is the final step to move to a sustaining phase and a predictable level of desired outcomes that require continued monitoring to safeguard against improper levels of variation (Chaneski, 2016; Phruksaphanrat, 2019; Thomas et al., 2016).

Chaneski (2016), Gandhi, Sachdeva, and Gupta (2019), Muraliraj et al. (2018), Thomas et al. (2016), and Uluskan (2019) indicated that manufacturing business leaders use the DMAIC Six Sigma tool to examine the level of variation for improvement or correction. Manufacturers assume that the right use of Six Sigma statistical tools will accurately represent the characteristics of processes, thereby providing data that lead to the improvement of those processes. Restricting flow as a process improvement also helps to increase production outputs or production volumes.

Many manufacturing business leaders have successfully used other LSS tools such as value stream analysis, kaizen, total quality management (TQM), and just-in-time (JIT) to remove waste, improve quality, develop documentation, and improve flow (Cox & Ulmer, 2015; Knol, Slomp, Schouteten, & Lauche, 2018; Lande, Seth, & Shrivastava, 2019). Manufacturing business leaders began using TQM during the 1930s (Bozdogan, 2010). By the 1950s, manufacturing business leaders were using TQM to help them achieve customer satisfaction. A commitment from cross-functional team members and top-level management is critical in using TQM and in beginning the process of understanding what customers identify as quality (Cox & Ulmer, 2015).

Andreadis, Garza-Reyes, and Kumar (2017), Ramesh and Kodali (2012), and Shou, Wang, Wu, Wang, and Chong (2017) observed that process activity mapping originated within industrial engineering and involves using a collection of methods to remove irrationality, inconsistency, and waste from processes to deliver products and services faster, easier, and cheaper. Ramesh and Kodali indicated that the value stream mapping process encompasses six steps (a) review the flow within the process or processes, (b) detect waste, (c) consider efficient approaches to the flow of the process, (d) consider an improved model for flow, (e) use a different layout, and (f) evaluate. According to Cox and Ulmer (2015), the process of conducting value stream analysis lasts, on average, 1 or 2 days and involves a team of employees with diverse knowledge in manufacturing, planning, and quality.

Ohno (1988) and Suárez-Barraza and Rodríguez-González (2015) indicated that kaizen is a Lean tool rooted in ancient Japanese philosophy. The idea behind kaizen was to work toward perfection continuously and in all areas of one's life. According to von Thiele Schwarz, Nielsen, Stenfors-Hayes, and Hasson (2017), manufacturing business leaders use kaizen to examine the functions of each employee, regardless of level. Business leaders also use kaizen tools to facilitate and engage employees in solving problems. Business leaders use kaizen tools like the kaizen board to support communication between employees and promote working together to solve problems.

Ohno (1988), Gunasekaran, Yusuf, Adeleye, and Papadopoulos (2017), and Yin, Stecke, and Li (2018) noted that manufacturing business leaders also use JIT, which is another Lean tool and is based on a Japanese expression that means not too early and not

late but rather having enough product at the right time before exhausting the existing supply. Manufacturing business leaders can also use JIT to understand the appropriate flow of materials throughout the process without disruption or defects. Ohno (1988), Che-Ani, Kamaruddin, and Azid (2017), and Yin (2018) also indicated that business leaders use JIT to achieve cost savings by reducing rework and transit time between processes, limiting excesses in inventory levels, and providing quality checks.

Complementary Methodologies

Project management. Project management is a complementary methodology to LSS because business leaders use these methodologies to document plans, communicate with stakeholders, review cycles, and manage resources. Project managers use the *Project Management Body of Knowledge* as a reference for the standards established by the Project Management Institute (PMI) as best practices for managing projects (Galli, 2018). The PMI has accreditation from the American National Standards Institute, which sets the standard for best practices in managing project achievement. Galli (2018) indicated that the *Project Management Body of Knowledge* has information on best practices, terms, and definitions. The organizational leaders of PMI established the definition of project management as a "temporary endeavor undertaken to create a unique product, service, or result" (Ng, 2018; PMI, 2017, p. 1). Project management encompasses five phases (a) planning, (b) initiating, (c) execution, (d) control, and (e) closing. Business leaders use these five phases to apply a structured approach to any project to develop new products and improve processes (Munk, 2015; Ng, 2018).

According to Galli (2018) and Vijaya Sunder (2013), LSS combined with project management helps business leaders create a plan for successful projects. Business leaders use project management as a guide or structure to complete LSS projects on time and within budget. Both Galli and Vijaya Sunder wrote that the initial point of integration in project management and LSS methodologies is the project life cycle. Using LSS adds statistical tools that clarify the root cause of the problem, which eliminates potential inaccuracies identified by stakeholders. Further, both Galli and Vijaya Sunder indicated that manufacturing business leaders use specific tools such as control plans to eliminate potential inaccuracies. One specific tool used during the life cycle of a product is DMAIC, which enables business leaders to identify decision points in design, testing, and implementation.

New mental model. Price (2014) observed that another complementary methodology for the successful use of LSS is creating a new mental model, which helps manufacturing business leaders and employees identify the connections among the activities and tools used on LSS projects. According to Price, few manufacturing business leaders have a focus on strategic objectives at the onset of implementing LSS. According to Minkin (2017), Westbrook (2006), Xie, Zhou, and Wang (2017), the new mental model theory refers to a way of thinking based on knowledge and truth as opposed to using guidelines or the memory of general rules as the basis. Following guidelines or general rules often restricts a person's reasoning in considering other alternatives to achieve an objective or goal. Price noted that the reasons for this lack of focus on strategy stem from a belief that developing a strategy is complex and from a lack of standard

practice in identifying a strategy. Additionally, Price noted that a significant issue in achieving new mental model thinking is gap analysis on areas such as cost, productivity, quality, and reliability. Analytics using gap analysis can provide performance measures against best practices and current processes in achieving cost-saving opportunities.

Price (2014) indicated that manufacturing business leaders who use the new mental model methodology should keep the new mental model simple and easy to understand. Manufacturers should ask themselves one overarching question: What is required to operate or what can improve the business to mitigate project costs? Associated subquestions should also aid in addressing the overarching question on what is achievable. Additionally, Price noted that incorporating a practice for setting strategy serves to encourage efficiency and consistency of outcomes. Manufacturing business leaders who use the new mental model obtain an improvement agenda that aligns with LSS tools used on LSS projects. Manufacturing business leaders can also use the new mental model to complete LSS projects or improve performance on previously hindered LSS projects.

Competing Methodologies

Balanced scorecard. Foley (2015) noted that, although LSS is one of the most effective methodologies to achieve improvements, other researchers have indicated that the balanced scorecard is a competing methodology. Manufacturing business leaders use the balanced scorecard to achieve continuous improvement and the ability to explore different points of view, such as financial, consumers, practices, and knowledge or growth, in achieving the goals of a manufacturing business. Developed by Kaplan and

Norton (1998), business leaders use the balanced scorecard to achieve complementary financial measures through operational measures. According to Foley, manufacturing business leaders use the balanced scorecard to examine strategic operations, develop strategic plans, and concurrently measure the performance of those plans against business objectives. Manufacturing business leaders who use the balanced scorecard also obtain insights into the levels of cohesiveness between internal departments.

Dhamayantie (2018) and Foley (2015) concurred that business leaders obtain benefits from using both LSS and the balanced scorecard methodologies, but Foley also indicated that the two methodologies are costly to implement. Although LSS and the balanced scorecard methodologies are costly to implement, the methodologies have significant competing aspects between them. The balanced scorecard is most effective if implemented from the top level of leadership with a focus on the distribution and execution of strategy to achieve change management. Foley indicated that manufacturing business leaders use the balanced scorecard to examine performance using cause-and-effect relationships to promote change. Unlike the balanced scorecard, leadership must support the implementation of LSS, though LSS experts can implement it directly and achieve the successful completion of projects. According to Mehralian, Nazari, Nooriparto, and Rasekh (2017), manufacturing business leaders who use the balanced scorecard in conjunction with LSS can optimize improvement objectives and support defined and quantifiable objectives.

ISO 9001 and PDCA. International Organization for Standardization (ISO) 9001 and plan, do check, act (PDCA) are a methodology and tool combination that competes

with LSS and DMAIC (Pietrzak & Paliszkiewicz, 2015). ISO 9001 is a customer-focused quality management system used by manufacturing business leaders internationally to certify the ability to manufacture and deliver quality products and services based on customer requirements and regulatory requirements (Hadidi, Assaf, Aluwfi, & Akrawi, 2017). Manders, de Vries, and Blind (2016) and Wang (2018) described ISO 9001 as a methodology that contains eight units, (a) customer focus, (b) leadership, (c) involvement of people, (d) process approach, (e) system approach to management, (f) continual improvement, (g) factual approach to decision making, and (h) mutually beneficial supplier relationships. Manufacturing business leaders use the first three units to document guidelines, and they use the remaining five units to obtain information on how to implement the standards identified in the first three units. Business leaders implement ISO 9001 to examine processes from a global perspective to conduct problem solving and achieve continuous improvement (Manders et al., 2016; Tomic & Spasojevic Brkic, 2019; Wang, 2018). According to Hammar (2015), Jagusiak-Kocik (2017), and Johnson (2016), manufacturing business leaders use PDCA within the ISO 9001 methodology to establish a quality management system and achieve continuous improvement. Business leaders use PDCA to examine processes to correct problems and make improvements using the four major steps of the tool (plan, do, check, and act) to drive team and project efficiency (Hammar, 2015; Jagusiak-Kocik, 2017; Realyvásquez-Vargas, Arredondo-Soto, Carrillo-Gutiérrez, & Ravelo, 2018).

Though researchers indicated that business leaders use ISO 9001 and PDCA to either establish quality management systems or obtain ISO 9001 certification (Hadidi et

al., 2017; Hammar, 2015; Manders et al., 2016; Pietrzak & Paliszkiewicz, 2015), business leaders use LSS methodologies and tools to identify, examine, and implement improvements to process and remove defects (Albliwi et al., 2014; Denning, 2011).

Agile. According to Dingsoeyr, Falessi, and Power (2019), Serrador and Pinto (2015), and Walczak and Kuchta (2013), Agile is a competing methodology established during the 1990s and implemented by leaders of manufacturing businesses. The focus for manufacturing business leaders who use Agile is problems or risk mitigation in projects for developing information systems. Withanagamage, Ratnayake, and Wattegama (2018) indicated that Lean is the foundation for Agile and most frequently used with traditional manufacturing systems. Global consumers require high-quality products to meet their constantly changing demands, and flexibility within production systems is necessary to meet consumer demand. Abdallah and Nabass (2018) and Sánchez, Pérez-Pérez, and Vicente-Oliva (2019) indicated that business leaders use Agile to create flexible production systems to achieve the needs of consumers' demand for new products, whereas the objective of traditional lean manufacturing systems is to meet production objectives on the factory floor.

Though many theories and methodologies exist, I conducted a comparison of a few to demonstrate their usage. I also compared theories and methodologies against the theory of constraints and LSS to indicate strengths and weaknesses. My evaluation of the theory of constraints and LSS also provided a basis for their selection for this research study. To carry out this research study effectively, it is also important to explore how competition from foreign businesses has affected manufacturers in the United States.

Market Competition

Competitiveness is the ability of a business leader to sell products and services within the market. Globalization of the market has caused an increase in competition, resulting in the closure of some U.S. businesses (Chen, 2016; Dolata, 2019; Mitchell, 2012) and forcing other U.S. businesses in various industries to incorporate continuous improvement strategies (Albliwi et al., 2014, 2015; Amin & Karim, 2013; Kandogan, 2014; Karim & Arif-Uz-Zaman, 2013; Kavčič & Gošnik, 2016; Laureani & Antony, 2012; Raval, Kant, & Shankar, 2019; Snee, 2010; Vienazindiene & Ciarniene, 2013). According to Kandogan (2014) and Moreira, Simoes, and Crespo (2017), global trade laws were rigid for several years, which limited the presence of foreign products within the domestic market. Kandogan (2014) wrote that reforms within international trade laws influenced globalization and regions and countries such as Latin America, Eastern Europe, India, and Russia benefitted from the reforms. Business leaders in some foreign countries took advantage of the new reforms that influenced a competitive global market and caused the decline of powerful markets in Western Europe and North America.

Mitchell (2012) contended that a critical problem plaguing the United States in its diminishing leadership role is the aerospace and the defense industries. Without a leadership role, the United States could lose the opportunity to obtain significant financial gains from market growth. Rose-Anderssen, Baldwin, and Ridgway (2011) and Spasojevic Brkic and Tomic (2016) noted that leaders in the aerospace and defense industry face challenges in adopting strategies such as LSS to reduce operational costs.

According to Rose-Anderssen et al. (2011), the initial production of aircraft carriers was an internal core competency of aerospace businesses. Suppliers benefitted from small functions outside of their core competencies. Competition existed among the supplier businesses for non-core-competency work. Hence, collaboration was mainly between domestic aircraft businesses until the 1950s when aircraft production collaborative efforts increased supplier involvement (Rose-Anderssen et al., 2011).

MacPherson (2009) and Rose-Anderssen et al. (2011) indicated that aerospace and defense manufacturing businesses are predominantly American and that aerospace and defense manufacturing business leaders are responsible for maintaining and developing critical and technological intellectual property that requires unique capabilities and skills to satisfy the current and future innovative needs of customers, consumers, and national security. However, due to offsets incorporated into contracts for aircraft purchases, businesses in China could potentially become competitors. MacPherson explained that Chinese aerospace businesses might become the largest consumer of aircraft by 2020, which would make them an attractive customer for leaders of aircraft manufacturing businesses eager to increase sales volume and profits. Moreover, Chinese business leaders require special agreements or offsets as a condition to purchase aircraft, such as requiring the aircraft manufacturer to provide aspects of the production to the purchaser. In this manner, Chinese businesses have become a supplier by producing the aircraft purchased using production sharing. Through production sharing, Chinese business leaders have gathered intellectual property and expertise from U.S. aerospace manufacturers to advance their goal of successfully competing with them

(MacPherson, 2009), which is another reason the leaders of U.S. businesses, particularly in aerospace, require continuous improvement strategies such as LSS to minimize waste and to address current and future competition. Competition because of globalization is a primary factor in losses for the U.S. economy and businesses and poses a threat to businesses leaders who lack the appropriate strategies and approaches to compete.

Significant changes in support of continuous improvement occurred during the 1970s when Goldratt established the theory of constraints and helped business leaders explore how to take advantage of limitations identified as constraints (Alvarez et al., 2017; Goldratt, 1988; Kuruvilla, 2017; Trojanowska & Dostatni, 2017). As in the case of using Lean, business leaders rely on assumptions such as the use of speed, volume, and existing processes will help to achieve output in using the theory of constraints (Alvarez, et al., 2017; Trojanowska & Dostatni, 2017).

Figure 2 represents how leaders can apply LSS tools using the theory of constraints. Manufacturing business leaders who select the correct LSS tools during the appropriate cycle phase using the theory of constraints can remove or take advantage of the constraints to mitigate projects' costs. Manufacturing business leaders can use the phases within the cycle to help leaders identify what specific tools to use as well as when to apply those tools.

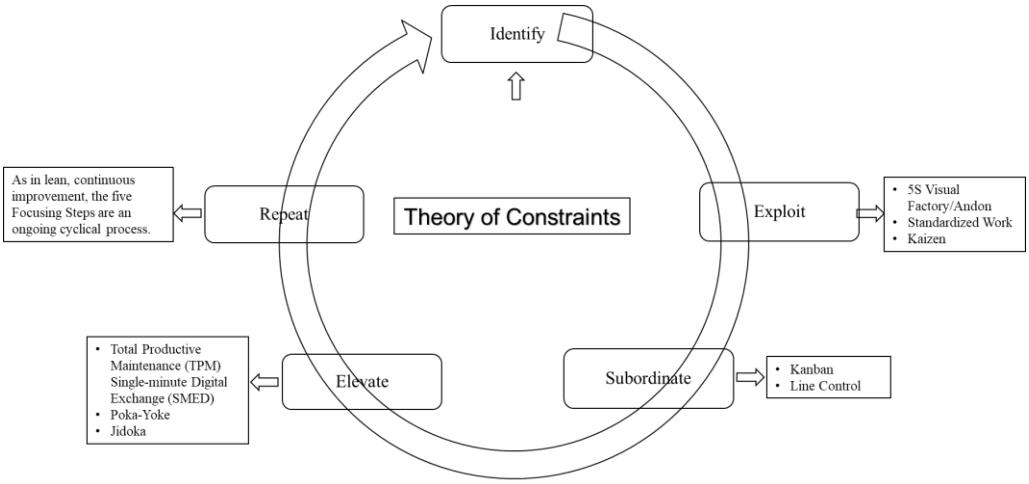

Figure 2. Five focusing steps to identify and eliminate constraints. From "Theory of Constraints," by Lean Production, 2016. Retrieved from http://www.leanproduction.com/theory-of-constraints.html. Copyright 2011–2016 by Vorne Industries Inc. Adapted with permission.

Although popular among business leaders in the United States for a variety of reasons, the theory of constraints is difficult for many manufacturing workers to support (Fourie, 2015). Moreover, instruction of the theory is not widespread in academic curricula. Practitioners in some consulting firms who use the theory of constraints have adapted models for their services but call it something different. Some consulting business leaders have incorporated the theory of constraints into their improvement programs but refer to it as Lean. Fourie (2015) indicated that manufacturing business leaders purchasing the service are often unaware they are incorporating the theory of constraints within their processes. The lack of knowledge about the theory of constraints compared to other popular methodologies hampers increased gains from improvement programs such as LSS.

Deming (1985) wrote that competition was a primary factor in losses for the U.S. economy and businesses. To combat competition, Deming asserted that business leaders

should focus on long-term profitability goals as opposed to short-term profitability goals and work to eliminate profit sharing. Deming also noted that achieving improved production or quality while benefiting from lower production costs will provide an opportunity for business leaders in the United States to maintain stability in the market, employ workers in the United States, and hold off the competition. According to Deming, the most effective way for businesses leaders to combat competition is by devising ways to improve production, lower costs, and increase value for consumers via continuous improvement. The following section includes an exploration into the evolution of continuous improvement strategies of business leaders in the United States to combat and mitigate project costs to obtain cost savings for a competitive advantage.

Continuous Improvement Strategies

Early continuous improvement strategies. Ohno (1988), considered the pioneer of the Toyota Production System, noted that, in 1937 and 1938, business leaders in the United States led production over the Japanese, and U.S. manufacturers produced goods at a rate almost 10 times that of Japan. According to Ohno, production processes in the United States eventually led to improvements in the Japanese production system that resulted in the Japanese rate of production growing to approximately eight times that of manufacturers in the United States. Ohno noted that this was a strong indicator that the incorporation of more improvements in the Japanese automotive industry would provide greater gains in the market. The Ohno System became the philosophy by which Japanese production made strides in gaining a greater share of the market. Taking cues from the Ford Motor Company production business, Ohno understood that safe conditions and

quality were paramount, and the reduction of defects was essential to reducing costs. Ohno identified seven types of production waste that require removal to achieve process improvement: overproduction, inventory, extra processing steps, motion, defects, waiting, and transportation. The Ohno System evolved into the Toyota Production System that became a series of innovations or continuous improvements.

Jasti and Kodali (2015) noted that it took Toyota half a century to lead the world market in the automotive industry because of the Toyota Production System. According to Garvin (2015), the use of the Toyota Production System design works well in a production setting with high volumes and a limited product mix, which makes it applicable to various industries and includes the use of kanbans, which are pull-production practices that serve as links between workstations throughout the value chain to allow for JIT. Garvin posited that manufacturing business leaders who use JIT can ensure upstream activities receive only the number of parts that the downstream activities will use.

Manufacturers in the United States continued to experience a decline in the market due to competition from an influx of imports, particularly from Japan during the late 1950 and early 1960. The competition posed a serious threat to business leaders unprepared to respond with the appropriate information and talent. According to Alvarez, et al. (2017) and Karim and Arif-Uz-Zaman (2013), global competition has challenged manufacturing business leaders in the United States to implement new strategies to improve their capacity for growth and provide customers with high-quality products with

short life cycles and at a low cost. During the 1950s and 1960s, Americans turned to strategies such as restructuring and offshoring to reduce costs and compete.

Restructuring. According to Deming (1985), business leaders used restructuring to achieve organizational changes that enabled them to expand their management layers and protect profits. The restructuring included the development of departments such as finance and legal, which helped businesses stay profitable. Business leaders used the finance department to help focus on improving decision-making abilities and increasing profits. Business leaders used legal departments to improve the management of legal affairs that grew in importance to protect financial interests and elude acquisition. Although business leaders established finance and legal departments to help business leaders combat competition, they contributed to competition because they did not focus on outperforming competitors.

Offshoring. Cottyn, Van Landeghem, Stockman, and Derammelaere (2011) noted that, during the 1970s and 1980s, business leaders required more flexibility to manage their business but there were too many management layers, so another strategy to compete involved identifying functions that they could outsource or offshore. Businesses traditionally encompassed total ownership and controlled all assets of the business (Handfield, 2006). However, as companies' global reach expanded, business leaders frequently implemented outsourcing strategies, commonly known as offshoring (Hansen, Mena, & Skipworth, 2017; Ishizaka, Bhattacharya, Gunasekaran, Dekkers, & Pereira, 2019; Johansson & Olhager, 2018; Stentoft et al., 2018). Offshoring refers to relocating production activities to drive efficiency and cost savings. In offshoring, business

functions or activities formerly conducted in house transfer to an external business that is often overseas (Hansen et al., 2017; Johansson & Olhager, 2018; Stentoft et al., 2018). Ellram, Tate, and Petersen (2013) noted that the various factors driving location decisions for production fall into three theoretical propositions that are the basis of Dunning's (1988) eclectic theory, which concern ownership, location, and internationalization. The eclectic theory is the basis for leaders of multinational enterprises determining ownership, location, and internationalization advantages (i.e., protections against failure in the market).

Business leaders who used offshoring obtained savings on wages and salaries or proximity to natural and human resources, but leaders of U.S. businesses that offshored reaped only short-term benefits due to various challenges (Hansen et al., 2017; Johansson & Olhager, 2018; Stentoft et al., 2018). Industries such as aerospace are in jeopardy of losing market share to foreign businesses due to piracy of intellectual property and loss of innovation. Offshoring to China risks increased piracy of intellectual property and the potential of the Chinese military to become a major power rivaling the United States (Navarro, 2013). Decisions to offshore production often take place with limited financial information, which negatively affects innovative capabilities. Various domestic industries have lost their dominant position in the global market because of offshoring (Pisano & Shih, 2012).

MacPherson (2009) posited that due to the increased dependence on foreign suppliers, emerging countries such as China, India, and Russia have collected intellectual property and knowledge for many years from U.S. businesses such as aerospace

manufacturers through contractual offsets and noted that this knowledge could position them to compete with U.S. companies. Petersen (2011) and Malm, Fredriksson, and Johansen (2016) defined offsets as nonmonetary compensation or a condition of sale for products required from the buying country. In conducting a review of government policies, Petersen indicated that the ramifications of the lack of government oversight cost the United States billions of dollars in losses to foreign countries. Petersen also noted that government controls need to be in place to ensure national security.

Hansen et al. (2017) and Navarro (2013) wrote that business leaders who outsource work in support of innovation must also protect intellectual property. If negotiations do not include nondisclosures within contracts, the primary business is susceptible to losses in intellectual property (Navarro, 2013). Hansen et al. posited that using strategies such as processing services at different locations might help to reduce intellectual property loss. Navarro noted that business leaders should use nondisclosure and joint agreements to help ensure the protection of intellectual property rights. Moser (2013) indicated that leaders of manufacturing businesses must focus on the total cost of ownership analysis, which can help them calculate the true cost of offshoring.

Hansen et al. (2017) and Mykhaylenko, Motika, Waehrens, and Slepniov (2015) reported that the basis for transferring U.S. businesses abroad for foreign market share or raw materials is the impression that offshoring is a profitable way for business leaders to maintain a competitive advantage. According to Mykhaylenko et al., outsourcing or offshoring business functions should not include the competencies or knowledge at the core of a business. Imberman (2013) wrote that leaders of manufacturing companies who

transfer manufacturing to foreign locations for lower labor costs incur increased costs for transportation, tariffs, and training costs for foreign workers.

According to Markides and Berg (1988), offshored manufacturing is most promising when three conditions exist: U.S. currency is strong within the global market, emerging market wages are low, and there are few or no trade barriers. Based on a survey of manufacturers conducted for the National Association of Accountants, decisions to offshore manufacturing can promote cost savings on labor, but labor costs are only 15% of the total operating costs and thus provide a limited return on investment (Markides & Berg, 1988). Markides and Berg (1988) also indicated that other problems with offshoring include the failure to benefit from economies of scale in the United States and a decrease in customer loyalty.

Porter and Rivkin (2012) identified the lack of action on the part of the U.S. government to resolve issues related to international trade laws and taxation policies as a factor making domestic production unattractive for many manufacturers in the United States. Markides and Berg (1988) wrote that increases in offshoring negatively affect the U.S. economy with the loss of jobs and increases in the U.S. trade deficit. Moser (2013) estimated such losses to be $600 billion a year. Imberman (2013) indicated that business leaders who are continuing to offshore production experience increased labor and production costs as well as competition.

According to Gobble and Holden (2012), researchers at the Boston Consulting Group determined that there is a growing trend in reshoring manufacturing from other countries back to the United States, as well as in making improvements in the

manufacturing processes such as lean manufacturing. Gobble and Holden also indicated that the Hackett Group surveyed business leaders to examine the number of U.S. company jobs in China versus the number of jobs reshored to the United States. In addition, Gobble and Holden indicated that the number of jobs reshoring was increasing due to increased wages in China and increased global transportation costs.

Lampert and Kim (2019) and Gobble and Holden (2012) and the authors of a study by AlixPartners questioned the impact of reshoring and noted that reshoring involved bringing manufacturing from distant locations such as China to locations closer to the United States, such as Mexico. Selko (2012) indicated that company executives in the United States are moving manufacturing from distant countries such as China to closer locations such as Mexico due to higher costs for production, despite extreme corruption and illegal drug trade wars, risks to intellectual property, and other trade issues. Mexico has a growing population of educated, inexpensive labor. To regain dominance, many manufacturers in the United States have turned their focus to low-cost and efficient production processes by adopting LSS (Barbosa, Carvalho, & Filho, 2014).

Evolution of Lean Six Sigma. As discussed earlier in this review, Lean and Six Sigma evolved from being standalone management methodologies to a combined, strategic LSS methodology used to mitigate project costs and achieve continuous improvement. Business leaders use the combined LSS methodology to take advantage of a variety of tools associated with each methodology to optimize cost savings by mitigating project costs, making improvements in processes, and reducing the number of

defects. Exploring the influence of the individual methodologies and the associated tools can help in understanding the potential of LSS.

Six Sigma. Antony et al. (2017) indicated that business leaders use Six Sigma to obtain information needed for making improvements in practices and processes and for reducing defects within production. Business leaders can also use Six Sigma to solve problems within processes or products by identifying the root cause to reduce the number of defects to a rate of 3.4 defects for every million products (Kumar & Kaushish, 2015). Antony et al. reported that business leaders use Six Sigma to conduct improvement efforts to get products in the market and to achieve profits sooner (Kovach & Fredendall, 2014) but the lack of knowledge in implementing projects using Six Sigma tools often contributes to increased project costs (Albliwi et al., 2014, 2015).

Sigma (from the Greek letter s) represents controlling quality and is a measure that includes six levels used to describe variations in practice or throughput. Defects and product variability are quality issues that have negative cost implications for manufacturers (Minkin, 2017). Business leaders use Six Sigma to increase their ability to identify and remove opportunities for defects within processes (Antony et al., 2017; Chugani, Kumar, Garza-Reyes, Rocha-Lona, & Upadhyay, 2017). The history of Six Sigma goes back as far as the 1770s, and it became a measure for variation during the 1920s (Folaron, 2003). Six Sigma gained in popularity within the Motorola Company during the 1980s as a strategic and profitable way to maintain consumer interest. The main premise of Six Sigma was to provide measures that contain information used to achieve process improvements and focus on problem solving with statistical tools that

identify waste and guidance to improve production (Arumugam, Antony, & Linderman, 2016).

According to Alsaffar and Ketan (2019) and Antony et al. (2017), business leaders who use the right Six Sigma tools such as DMAIC can forecast probable outcomes of a process. Business leaders use DMAIC to identify structure and discipline and to take advantage of subject matter expertise that requires varying levels of training to promote and extend continuous improvement efforts. Antony et al. indicated that business leaders who use the Six Sigma tool DMAIC can obtain statistical information such as performance and customer measures within unique structures that are suitable for implementing continuous improvement projects. Business leaders also use DMAIC to examine the level of variation for improvement, such as cycle time. Shorter cycle times involved in producing a profitable product from a raw material enable manufacturers to satisfy customers and achieve profits sooner.

Although business leaders have a long history of using Six Sigma to resolve problems that result in the cost of poor quality, challenges in understanding how to implement and use Six Sigma tools can result in project failures that increase project costs. Though business leaders who use Six Sigma are equipped with processes and tools that enable sustainability and cost reduction (Antony et al., 2017; Chugani et al., 2017), they often lack knowledge on how to use the statistical tools, which often results in higher project costs (Albliwi et al., 2014, 2015; Antony et al., 2017; Chugani et al., 2017). Some business leaders use personal judgment to determine their strategies for LSS implementation (Albliwi et al., 2015).

Lean. Lean manufacturing and Lean production also represent a philosophy or way of thinking that stems from customer-focused improvements to processes that lead to a competitive edge within the global economy. Other names used to describe Lean include Lean manufacturing and the Toyota Production System. The basis behind Lean is to add value for customers while limiting or reducing waste in production cycles and resource use. Some aspects of value creation include understanding what the consumer wants, when the consumer needs to have it, what price the customer would be willing to pay, and how to deliver what the consumer wants (Antony et al., 2017; Chugani et al., 2017; Raval et al., 2019; Sreedharan et al., 2018; Vijaya Sunder, 2013). Manufacturing business leaders can use Lean tools to identify and remove waste from their production processes. Waste refers to non-value-added activities or activities not needed in the development of a product. Identifying value, identifying the value stream, structuring, improving flow, allowing customer pull, and working toward a perfect process are all steps involved in Lean thinking for waste elimination (Antony et al., 2017; Chugani et al., 2017; Sreedharan et al., 2018; Vijaya Sunder, 2013; Yadav, Jain, Mittal, Panwar, & Lyons, 2019).

Manufacturing business leaders who practice lean thinking in production use a series of tools and techniques to make optimal use of time, human resources, assets, and productivity while simultaneously increasing the degree of quality in their products or services (Antony et al., 2017; Chugani et al., 2017; Sreedharan et al., 2018; Yadav et al., 2019). In addition to improving quality, Sreedharan et al. (2018) indicated that Lean manufacturing encompasses other management practices, such as JIT, teamwork, and

supplier management that business leaders use as a systematic approach. Sreedharan et al. (2018) also wrote that business leaders who use Lean projects begin with a focused planning phase for change. The planning phase for change should encompass the need for a change throughout an organization and culture and should support senior leaders gaining the trust of everyone involved. Business leaders use a documented plan in implementing Lean that incorporates specific areas for transformation, the progress of projects, and an examination of effectiveness. When implementing Lean, business leaders also take advantage of teams from multiple organizational functions that work cohesively to achieve project objectives. Successful projects should result in the removal of waste; continuous improvement; continuous flow and pull production systems; and flexible, functional teams and information systems. Antony et al. (2017) also indicated that reporting the continuous measurement of Lean's effectiveness and additional Lean goals and objectives underscores the importance of communication for Lean projects and the need for its incorporation into an existing business culture.

Antony et al. (2019), Čiarnienė and Vienažindienė (2012) observed that, although the use of Lean is widespread, only 70% of business leaders obtain the full benefit of the projects. Manufacturing business leaders must ensure consistency in the development and production of a product or service by using LSS. Business leaders must also ensure the selection of the right LSS tools to mitigate project costs.

Lean Six Sigma. The combination of LSS methodologies is a preferred strategy for business leaders because it allows for root-cause problem solving, waste elimination, the elimination of defects, controls, and cultural changes to promote quality (Antony et

al., 2017; Chugani et al., 2017; Lande, Shrivastava, & Seth, 2016; Sreedharan et al., 2018). Business leaders use LSS to focus on consumer satisfaction and use analytical data to make decisions and improve the bottom line for business profitability. Top management investment is significant in the deployment and maintenance of LSS (Antony et al., 2017; Lande et al., 2016).

Additionally, the LSS methodology is different from other improvement strategies (Kovach & Fredendall, 2014) due to the use of specially trained employees who have the knowledge to resolve problems (Chugani et al., 2017). Antony et al. (2017) and Arumugam et al. (2016) indicated that the LSS training for employees encompasses levels and positions called the Yellow, Green, and Black Belts. The Yellow Belt refers to Six Sigma participation in a 1-day training that provides overall knowledge on LSS. The Black Belts and Green Belts are necessary for LSS projects. Green Belts are implementers on LSS projects across functional organizations that serve as quality professionals. Aligning with operations management, Black Belt professionals identify the resources needed from functional organizations, design curricula, and conduct the needed training (Antony et al., 2017; Arumugam et al., 2016).

Vijaya Sunder (2013) noted that Black Belt professionals also work with management to develop a list of opportunities for improvements or projects. Operational leaders and LSS Black Belt professionals conduct prioritization and resource allocation to evaluate projects. Black Belt professionals are also integral to planning, coaching, and instruction. To achieve the desired objective, Black Belt professionals who also serve as coaches for teams should participate in projects until completion. Black Belt

professionals and operational leaders also have the responsibility to quantify the benefits of projects (Vijaya Sunder, 2013). Researchers have indicated that implementing LSS is expensive and includes expenses for travel, consultants, and specialized Black Belt, Green Belt, and Yellow Belt training for potential subject matter experts (Amin & Karim, 2013) costing businesses as much as $2,000 for a course for one employee (American Society for Quality, 2018).

Laureani and Antony (2012) surveyed 600 business leaders in the manufacturing and service industries on critical success factors for LSS projects. The participants scored a list of critical success factors in order of importance. The top scores for critical success factors for LSS projects were a strong commitment from top management (4.63), cultural environment (4.35), and alignment to strategic business goals (4.26). The selection of the right LSS tools also figured prominently as a critical success factor (3.65).

The critical success factors are prescriptive elements to successful LSS projects. Business leaders who do not use the critical success factors run the risk of project failure. LSS tools and techniques are a critical success factor. Critical success factors complement the theory of constraints because business leaders can use the factors in support of LSS project planning.

Albliwi et al. (2014) identified 34 critical failure factors through a review of papers written from 1995 through 2013 that included Lean, Six Sigma, and LSS. The leading causes of failure included limited commitment from top management, poor or limited training to conduct the projects, incorrect prioritization, and wrong projects selected. According to McLean and Antony (2014) and Secchi and Camuffo, the critical

failure factors correlated with management leadership. Albliwi et al. noted other important critical failure factors are a lack of alignment with strategic business goals, selecting the wrong people to work on the project, and selecting the wrong LSS tools. McLean and Antony (2014) and Rexeisen, Owens, and Garrison (2018) indicated that the findings for the studies on critical failure factors and critical success factors for LSS projects were consistent. McLean and Antony and Albliwi et al. recommended continued research on critical failure factors in various industries such as manufacturing.

Leaders who avoid critical failure factors may achieve successful project outcomes. Critical success factors complement the theory of constraints because business leaders can consider them during the planning phase of a project.

Summary of the Literature Review

U.S. manufacturing businesses such as aerospace have lost market share, jobs, and intellectual property to businesses in emerging overseas markets. This trend will continue without continuous improvements in products and services that customers value (Palomino, Medina, & Arellano, 2013; Vijaya Sunder, 2013). The need to be successful in continuous improvement strategies such as LSS is critical to manufacturing businesses' survival in the global market (Scharmer & Kaufer, 2013).

Several researchers have validated the ability to mitigate project costs with the successful implementation of LSS projects (Albliwi et al., 2014, 2015; Sony et al., 2019; Yadav & Desai, 2016). To achieve LSS benefits that include a cultural shift in how employees think about their work, manufacturing business leaders must spend money to implement LSS projects. The implementation of LSS involves various expenditures, including travel, consultants, and specialized training for potential subject matter experts (Black Belt, Green Belt, and Yellow Belt) costing as much as $2,000 a course for one employee (American Society for Quality, 2018; Amin & Karim, 2013). Regardless of the size of an organization, the cost savings from successful LSS projects can range from 1.2 to 4.5% of annual revenue if the implementation of LSS is successful (Cyger, 2019).

Marx (2019) wrote that aerospace companies such as the Boeing Company use LSS to promote continuous improvement to compete with Airbus, which holds 45% of the commercial aircraft market compared to Boeing's 43%. Leaders of the Boeing Company plan to regain a majority share of the market by taking advantage of the growth in the Chinese market, along with continued use of LSS. Marx indicated that the Boeing

Company's leadership did not initially mandate the use of LSS. The use of LSS began in 1999 as an effort by a few internal business leaders that spread to other areas of the business. The company also invested in Six Sigma Black Belt training for employees. By 2004, Boeing's business leaders indicated in their annual report that their use of LSS enabled them to mitigate project costs and achieve cost savings of $210 million.

As an underpinning of LSS, the theory of constraints is a conceptual framework that business leaders use to integrate across functions and systems to manage constraints (Alvarez et al., 2017; Kuruvilla, 2017; Trojanowska & Dostatni, 2017). Several characteristics in the theory of constraints align with or complement LSS. Business leaders use the theory of constraints in conjunction with LSS to achieve continuous improvement (Alvarez et al., 2017; Pacheco, 2014) and to explore and generalize cause-and-effect relationships within the production process (Alvarez et al., 2017; Kuruvilla, 2017; Trojanowska & Dostatni, 2017).

I also examined research that was critical for understanding the conditions and trends within the domestic market that promoted competition from emerging markets. The impact of globalization has forced manufacturing business leaders to maintain an organizational environment that is flexible and incorporates continuous improvement as a cultural philosophy (Lande et al., 2016). Global manufacturing business leaders require new strategic operations that offer an edge over their competitors and lead to increased profitability. Continuous improvement maximizes the quality of manufactured goods, reduces waste, and maintains basic operational practices and processes (Čiarnienė &

Vienažindienė, 2012; Cottyn et al., 2011; Hansen et al., 2017; Johansson & Olhager, 2018; Karim & Arif-Uz-Zaman, 2013; Ohno, 1988; Stentoft et al., 2018).

Also, understanding the early strategies and events that leaders of manufacturing businesses undertook to combat competition that offered U.S. businesses little to no success in mitigating project costs or gaining a competitive edge was critical to this research. Early strategies by business leaders in the United States did not include a focus on improving internal production processes that mitigated project costs. The leaders used strategies such as restructuring and relocating production to obtain cost savings. Restructuring led to the creation of finance and legal departments, which added management layers but did not improve strategies to produce products and services (Karim & Arif-Uz-Zaman, 2013).

The use of offshoring to obtain cost savings received some criticism because decisions stemmed from questionable financial information (Arnheiter & Meixell, 2011). Though Ellram et al. (2013), Hansen et al. (2017), and Johansson and Olhager (2018) described the benefits of offshoring, MacPherson (2009) indicated rising costs of wages, contractual offsets, and piracy of intellectual property pose significant risks. Boguslauskas and Kvedaraviciene (2009) reported that leaders of manufacturing businesses should not outsource or offshore work that is the core competency of a business, as this contributes to the loss of expertise and stifles innovation. Moser (2013) noted that leaders of manufacturing businesses need to conduct a cost-of-ownership analysis to determine if and where work should be outsourced or offshored and what type of work should be outsourced or offshored. Outsourced or offshored work must include

safeguards for intellectual property within contracts (Mehlman, Uribe-Saucedo, Taylor, Slowinski, Carreras, & Arena, 2010).

Japanese manufacturers used the Toyota Production System to become major competitors to U.S. businesses in industries such as automotive and aerospace. Ohno understood the benefits of incorporating low cost production and creating value for customers through continuous improvement efforts. Business leaders in the United States struggled to follow suit by focusing on internal strategies to mitigate project costs and build a competitive edge using Lean and Six Sigma (Garvin, 2015; Jasti & Kodali, 2015; Ohno, 1988).

Within the literature review, the evolution of LSS to mitigate project costs was significant to understanding the benefits and challenges manufacturing business leaders encountered with LSS tools. The emergence of LSS as a combined methodology occurred in the 1990s (Cox & Ulmer, 2015), though manufacturing business leaders found it easier to mitigate project costs and connect cost savings with the successful completion of Lean projects than with Six Sigma projects (Duncan & Ritter, 2014). Though the use of LSS is widespread, 70% of LSS projects fail (Sony et al., 2019). Achieving benefits from using the statistical tools of Six Sigma, such as DMAIC, to remove defects, improve quality, and make direct links to cost savings has been difficult for manufacturing business leaders. Despite the benefits of using Six Sigma, the leaders of many manufacturing businesses have chosen to forgo employing it because of the challenges involved in understanding how to use the statistical tools (Antony et al., 2017; Chugani et al., 2017).

Researchers have indicated that LSS has become a popular strategy for manufacturing business leaders to promote an environment for continuous improvement (Alexander, et al., 2019; Palomino, et al, 2013; Vicencio-Ortiz & Kolarik, 2012; Vijaya Sunder, 2013), yet Albliwi et al. (2014) and Albliwi et al. (2015) indicated that selecting the wrong LSS tools is frequently the cause of project failures. The failure of LSS projects is significant because LSS projects are costly to implement. The failure of LSS projects also limits the return on investment and the ability of manufacturing business leaders to mitigate project costs to obtain a competitive advantage. My research explored the successful strategies that LSS project leaders use to mitigate projects' costs may be valuable for aerospace manufacturing business leaders.

Transition

Within Section 1, I presented the problem statement and purpose of the study to explore the aerospace industry, the associated research and interview questions, the conceptual framework, the significance of the study and its potential social impact, and a review of relevant academic and professional literature related to the topic under study. In Section 2, I present the project research method and design, role of the researcher, qualifications for participants, sample, requirements for ethical research, criteria for data collection and analysis, reliability, and validity. In Section 3, I present the findings of the study, the application to professional practice, the implications for social change, the recommendations for action and further research, and a reflection on my experience within the doctor of business administration doctoral study process.

Section 2: The Project

Purpose Statement

The purpose of this qualitative single case study was to explore the successful strategies that LSS project leaders use to mitigate project costs within manufacturing. The targeted population were 17 LSS project leaders located at a single manufacturing business in the southeast and northwest regions of the United States who successfully implemented strategies to mitigate project costs. The findings from this study might provide project leaders with strategies that help to reduce project costs. Leaders of organizations who reduce project costs may contribute to social change through increased funding to social enterprises. Social enterprises are hybrid organizations that have both a business and a charitable objective that benefits the community (Powell et al., 2019). Increased funding for social enterprises could reduce poverty, unemployment, and homelessness within the community.

Role of the Researcher

Researchers serve as the primary instrument in qualitative research case studies and are embedded within the process of obtaining responses to the interview questions from the participants (Saunders et al., 2015; Yates & Leggett, 2016; Yin, 2018). I served as the primary instrument for this study. I guided the data collection of the study by directly engaging with the participants to obtain responses to research questions and conduct analysis of the data collected.

According to Yin (2018), researchers are responsible for building a relationship with the participants selected for a study. I ensured that participants understood the

objective of the study and were knowledgeable and comfortable responding to the interview questions. Although I lived and worked in a manufacturing community, there was no direct relationship between me and the study participants or the manufacturing business involved in the case study. I became interested in this topic because of the offshoring of manufacturing businesses in the city I grew up in, which signaled the decline of communities in the areas where those manufacturing businesses were located. I have limited practical experience with LSS but felt drawn to the potential outcomes of successful LSS projects that might promote maintaining or bringing back manufacturing businesses to the United States.

Pivotal to the role of the researcher is maintaining ethical standards. The *Belmont Report*, written in 1979, provides ethical guidance on selecting participants for research studies (National Commission for the Protection of Human Services of Biomedical and Behavioral Research, 1979). Following the guidelines of the *Belmont Report* prepared me to protect the rights of participants in the study. Guidance contained in the *Belmont Report* includes the following basic ethical principles: respect for persons, beneficence, and justice. Respect for persons refers to the treatment of participants within a study as individuals. Beneficence refers to the protection of individuals from harm. Justice refers to fairness regarding who benefits from the research (National Commission for the Protection of Human Services of Biomedical and Behavioral Research, 1979). Prior to the start of my study, I obtained approval from the Walden University Institutional Review Board (IRB) and from the case study business. I provided participants with an informed consent form, an overview of the study, and the opportunity to ask questions.

To mitigate bias, I used an interview protocol (see Appendix B). Researchers use an interview protocol to ensure the credibility and dependability of a study and to ensure the data collected represent the opinion of the research participants, not the researcher. Yin (2018) and Saunders et al. (2015) indicated that researchers use an interview protocol as guidance when collecting data to improve the degree of credibility and dependability within their study.

Participants

The participants for this case study were 17 leaders in an aerospace company located within the southeast and northwest regions of the United States who successfully implemented strategies to mitigate project costs. Participants had a minimum of 3 years of experience with LSS projects. All participants were at least 21 years of age and able to read, write, and speak English.

Recruitment plans for participants involved purposeful sampling using years of experience with the phenomenon. According to Saunders et al. (2015), purposeful sampling is suitable for use in qualitative research. Purposeful sampling is the intentional selection of participants whose input on the phenomenon will be information rich. Researchers use purposeful sampling to reach data saturation faster (Suri, 2011; Weller et al., 2018). I requested that an executive of the company assist with participant recruitment. I sent the executive an e-mail request for participation (see Appendix A). I requested that the executive send the call for participants to approximately 20 organizational leaders. The e-mail included two response categories: (a) potential participant meets the basic criteria for the study and attaches a copy of background

information regarding personal LSS experience or (b) potential participant does not meet the basic qualifications or will not participate. I also included information on the research study, benefits for participating, privacy requirements, and my university e-mail address. I requested all responses by close of business on the third day after the initial delivery date.

After receipt of the responses to the request for participants, I reviewed the experience and background information of all potential participants to ensure they met the qualifications for inclusion in the study as well as identified any questions for clarification of the potential participants' background information. I also ensured that the total number of potential participants was sufficient for the study before providing an overview of the research study, accompanied by a letter of introduction. Yin (2018) indicated that an overview of the study and a letter of introduction are appropriate to provide to participants in a case study.

To establish a relationship with potential participants, I sent the potential participants a letter of introduction and an overview of the study via e-mail to validate their agreement to participate in the study. A letter of introduction along with an overview of the study are appropriate to provide to participants in a case study (Yin, 2018). I also used the potential participants' background information to gain insights, ensured their background aligned with the research question, and asked any clarifying questions. The potential participants also received a copy of the informed consent form via e-mail to review. Signed copies of informed consent forms are necessary before data collection. Informed consent helps validate participants' protection of privacy (Curran,

Kekewich, & Foreman, 2018; Leedy & Ormrod, 2015). Before the start of the study, I reached out to all participants to thank them for participating, I reiterated the goals of the study, and I asked if they had any questions.

Research Method

The key research methods are quantitative, qualitative, and mixed. Researchers select the qualitative method because it is a rational approach to practical findings that align with research questions to acquire new knowledge (Mayer, 2015; Park & Park., 2016). Researchers also choose the qualitative research method because they can explore the complexity of the phenomenon in a real work environment (Leedy & Ormrod, 2015; Mayer, 2015). In addition, researchers can use a qualitative research method to gain knowledge through exploring the thoughts and opinions of individuals who have experience with the phenomenon under study (Bansal, Smith, & Vaara, 2018; Leedy & Ormrod, 2015; Park & Park, 2016; Yin, 2018).

I did not select the quantitative and mixed methods for the study because they were not suitable for addressing the research question. The intent of a qualitative research question is to help explore *what*, *how*, or *why* regarding a phenomenon (Leedy & Ormrod, 2015; Park & Park, 2016; Yin, 2018). Barnham (2015) posited that qualitative research is most frequently associated with *why* research questions. Researchers use qualitative research questions to gain an in-depth understanding of individuals' motives, behaviors, and attitudes. In contrast, researchers who intend to examine *what* regarding a phenomenon should select quantitative or mixed methods. Barnham also posited that

researchers use quantitative and mixed-method research questions to examine facts regarding numbers and percentages involved with a phenomenon.

Research Design

The research design selected was an exploratory case study. Yin (2018) described the research design as a logical plan of action chosen to address an initial question or set of questions and the researcher provides some set of conclusions (answers) about these questions. Researchers conduct exploratory research to identify themes resulting from the findings within the study (Leedy & Ormrod, 2015; Yin, 2018). A single case is enough to explore a common rationale or normal occurrences to obtain insights on processes (Bansal et al., 2018; Yin, 2018).

An exploratory research design was suitable for this study for several reasons. I conducted an exploratory research design to collect data from participants who are knowledgeable about the research question: What successful strategies do LSS project leaders use to mitigate LSS project costs? Researchers use an exploratory research design to explore real-world decisions (Leedy & Ormrod, 2015; Park & Park, 2016; Yin, 2018). Researchers also use exploratory research as groundwork for future research on the topic (Mayer, 2015). An explanatory research design was not suitable to address my research question. Researchers use an explanatory research design to explain the difference between variables (Saunders et al., 2015), which is not applicable for this study. I employed a qualitative, single case study to explore the phenomenon of LSS within a real-world context and to gain insights from individuals with knowledge of the

phenomenon. The basis for this research question stems from prior qualitative research on the topic of LSS critical failure factors (Albliwi et al., 2015).

One important aspect of qualitative research is determining data saturation. Data saturation is the point at which no additional information is obtained from responses to the interview questions (Hagaman & Wutich, 2017; Hennink, Kaiser, & Weber, 2019; Lowe, Norris, Farris, & Babbage, 2018). The researcher has the responsibility for determining data saturation and can conclude collection or analysis of the data (Cypress, 2018). I achieved data saturation with the initial sample.

Population and Sampling

The targeted population was 17 LSS project leaders located at a single manufacturing business in the southeast and northwest regions of the United States who successfully implemented strategies to mitigate project costs. Participants had a minimum of 3 years of experience with LSS projects and were between the ages of 21 and 60. Participants also were able to read, write, and speak English.

Recruitment plans for participants involved purposeful sampling using years of experience with the phenomenon and a focus on roles within the case study business. According to Leedy and Ormrod (2015), Onwuegbuzie and Collins (2017), Ranney et al. (2015), and Saunders et al. (2015), purposeful sampling is suitable for use in qualitative research. Purposeful sampling is the intentional selection of participants whose input on the phenomenon is information rich. Purposeful sampling is also known as judgmental sampling because it enables the researcher to reach data saturation faster (Weller et al.,

2018). Saunders et al. (2015) indicated that researchers cannot determine data saturation within purposeful sampling using a certain number of participants or statistics. When using purposeful sampling, researchers determine data saturation by the richness of the data acquired from the participants. For the purposes of this study, the sample included 17 participants.

Ethical Research

Yin (2018) noted that there are ethical considerations for every human participant in a research study. The researcher has a responsibility to ensure that participants understand a study and implications for them as participants in the study (Mumford, 2018). The Walden University IRB requires that I provide potential participants with protections to ensure their privacy. Informed consent is a form of protection that researchers use that involves open and voluntary discussions between the researcher and participant on what the research entails, the risks and benefits, expectations of the researcher, and participant rights to opt out of the study. Written consent using a consent form is documentation that the agreement to participate in the study is not based on an assumption. The consent form can also reflect a refusal to participate in the study. The informed consent form must be easy to read and understand and truthful (Ahlin, 2018; Sivanadarajah, El-Day, Mamarelis, Sohail, & Bates, 2017). I provided participants with an informed consent form, as required by Walden University, and an overview of the research purpose, the research question, the approximate duration of the interview, the participants' right to withdraw from addressing questions, risks and benefits, and full disclosure on recording participant responses.

Researchers must also provide truthful information through which participants can make informed decisions about participating in the study and ensure there is no pressure to sway participants during the study (CITI Program). Participants were able to leave the study and change their mind about being in the study at any time, without penalty. The informed consent forms also indicated that participation in the study was voluntary in accordance with Walden University guidelines. I also stated before the study that participants could let me know that they wished to opt out of the study at any time. None of the participants opted out of the study.

Ethical concerns also include risks that can compromise the research process. CITI training references financial and nonfinancial relationships as conflicts of interest. Financial interests relate to relationships where the participant, a third-party organization, or the researcher receives financial benefit because of the research. Risks also refer to nonfinancial interests from close personal relationships between the participants, a third-party organization, or the researcher that encompasses loyalty. I have no financial relationship with the company involved. In addition, I have no personal relationships with any of the participants or stakeholders within the company. No changes occurred during the research study that could have led to a conflict of interest.

As indicated in the Collaborative Institutional Training Initiative, privacy refers to the process of obtaining information from research participants (CITI Program). Ensuring the right to privacy in a research study involving people is critical. I treated all participants in a respectful and fair manner. I did not maintain any personal identifiable information beyond a consent form. No personal identifiable information will remain on

laptop computers, or other portable devices. I did not mention the name of the test case company within the research.

Protecting the confidentiality of participants is also an integral aspect of conducting research. Confidentiality relates to the combined efforts by me and by Walden University to protect information provided by the participants as part of the research study. Incorporating informed consent into the research process provides safeguards for participant confidentiality. I sought to acquire only minimal identifiable information as described within the interview protocol (see Appendix B), focus group protocol (see Appendix C), and participant questionnaire protocol (see Appendix D).

Storage of the data is also critical to protecting participant information during the research process (Yin, 2018). I stored all data collected in the research process on an encrypted USB file. I will retain the data collected from participants in the research study for 5 years. After 5 years, I will shred all documents using a crosscut shredder and destroy all hard drive data with a data destruction program.

A precondition to the commencement of the research at the case study site, approval from the IRB at Walden University. The final study includes Walden University's IRB approval number 05-22-20-0176953. In addition, I also completed ethical training through CITI prior to conducting the research. The Belmont Report indicates that the selection of participants for research studies must take place without prejudice and in fairness (National Commission for the Protection of Human Services of Biomedical and Behavioral Research, 1979). Walden University IRB guidelines require that I ensure equal distribution of benefits and risks.

Participant names will remain confidential and coded within my notes. The codes do not have a connection to the participants' names. Participant codes include either IP (interview participant) or FG (focus group participant) and a random number (see Table 2).

Table 2
Individual Participant Codes

Individual interviews	Focus group	Questionnaires
IP01	FG01	QP01
IP02	FG02	QP02
IP03	FG03	QP03
IP04	FG04	QP04

Personal identifiable information will remain separate from other information. No personal identifiable information will remain on laptop computers, personal digital assistant (PDA), flash drives, or other portable devices. I will contact the Walden IRB if there is a security breach of personal identifiable information. Data encryption is significant to protecting research data. Encryption ensures data are unreadable unless properly decrypted.

Data Collection Instruments

In an exploratory research design, combined with a qualitative method, the researcher serves as the instrument for collecting data (Gog, 2015; Leedy & Ormrod, 2015; Saunders et al., 2015). For this qualitative study, I served as the data collection instrument. I used individual semistructured interviews, a focus group, and a questionnaire for data collection. The research protocols in Appendices B, C, and D for the individual semistructured interviews, focus group, and questionnaire, respectively,

were the guides to prevent researcher bias, prevent flaws within the data, and maintain focus on the interview questions during data collection. Amankwaa (2016) and Yin (2018) wrote that a case study protocol encompasses an overview, procedures for data collection, and the interview questions. All participants provided a signed consent form to participate in the study.

Interviews

I conducted the semistructured interviews in-person at the case study site or on the telephone, depending on the preference of the participant. A semistructured interview is a formal conversation between two or more individuals led by an interviewer who is conducting a study on a specific subject or subjects (Park & Park, 2016; Saunders et al., 2015; Yin, 2018). As a guide for the interview process, I used an interview protocol (Appendix B) consisting of five interview questions. Before conducting the in-person interviews, I reviewed the informed consent document and obtained a signature. Participants involved in telephone interviews received the informed consent form via email before the interview. I requested a signed consent form be returned via email before the start of the interview. I also reiterated to the participants that I used audio recordings and notes to document responses. After transcription, participants had an opportunity for two days to review and make changes to their responses to the research question. The interviews lasted no more than an hour in duration.

Focus Group

I used the semistructured interview questions to collect data from focus group participants. Kellmereit (2015) noted that a focus group is a well planned discussion

among a group of two or more individuals at the same time on a specific subject or subjects and facilitated by a researcher. A focus group protocol (see Appendix C) to guide the flow of questions for the interviews. The data collected from the focus group occurred face-to-face at the case study location. Before conducting the focus group, I reviewed the informed consent document and obtained a signature from each participant. I also reiterated to the participants that I used audio recordings and notes to document responses. After transcription, participants had an opportunity for two days to review and make changes to their responses to the research question. The focus group lasted for no more than an hour in duration.

Participant Questionnaires

I also used a questionnaire containing the semistructured interview questions to collect data from participants (see Appendix D). Questionnaires are a set of questions listed in a specific order and administered to collect information for a study (Saunders et al., 2015; Yin, 2018). I administered the questionnaire via email. Participants had three days to return the completed questionnaire. Before administering the questionnaire, I distributed an informed consent form to participants and requested a signed consent form be returned prior to distribution of the questionnaire.

According to Ranney et al. (2015), designing a qualitative research study requires a significant amount of time to develop the data collection protocols. A poorly drafted protocol will result in a lack of reliability and validity within the data (Ranney et al., 2015). To address issues involved with reliability and validity after transcribing the audio recordings, I conducted member checking to provide participants an opportunity to

review and revise their responses prior to analyzing the data collected. Member checking is a method for enhancing rigor and ensuring reliability and validity of the data collected (Amankwaa, 2016; Birt, Scott, Cavers, Campbell, & Walter, 2016; Candela, 2019).

To eliminate researcher bias, I used research protocols. I identified research protocols for the following data collection techniques: individual semistructured interviews, focus group, and questionnaire. The research protocols are in Appendices B, C, and D.

Data Collection Technique

In this study, I used the open-ended interviews, focus group, and questionnaire to collect data to explore the research question. According to Lambert and Loiselle (2008), an advantage to using a combination of data collection techniques such as individual interviews and a focus group is enhancing the credibility and richness of the data. Ranney et al. (2015) indicated that another advantage to conducting interviews and focus groups is that the researcher has an opportunity to conduct a summary of the data collection activity and give participants an opportunity to share additional thoughts on the study.

Interviews

One data collection technique for this study was individual semistructured interviews with four participants. The researcher typically has a list of questions or a protocol. The researcher may add additional questions to probe further into the responses of the participant (Castillo-Montoya, 2016; Leedy & Ormrod, 2015; Saunders et al., 2015). I used an interview protocol (see Appendix B) to guide the flow of questions. The data collection for interviews occurred face-to-face at the case study location or by

telephone based on the convenience of the participant. An advantage to using individual semistructured interviews is the ability to obtain in-depth information and clarity from the participants during data collection (Castillo-Montoya, 2016; Leedy & Ormrod, 2015; Saunders et al., 2015; Yin, 2018). A disadvantage of using individual interviews is that the researcher must go to the participants' location for face-to-face interviews. Conducting interviews can also be time consuming and labor intensive (Leedy & Ormrod, 2015; Saunders et al., 2015; Yin, 2018).

Focus Group

Data collection for this qualitative single case study also involved a focus group with five participants. The data collection from the focus group occurred face-to-face at the case study location. I used a focus group protocol (see Appendix C) to guide the flow of questions for the interviews. An advantage to using a focus group is that the researcher can acquire diverse perspectives and insights on a subject or common experience from multiple individuals in less time than it would take to interview each individual participant (Bansal et al., 2018; Kellmereit, 2015; Saunders et al., 2015). One disadvantage to conducting a focus group is that some participant responses may influence other participant responses.

Participant Questionnaires

Questionnaires are another data collection technique selected for this study. Yin (2018) noted that an advantage of questionnaires is the researcher can obtain additional knowledge during the exploration of the phenomenon. I provided questionnaires (see Appendix D) to four participants via e-mail.

Individual semistructured interviews, a focus group, and a questionnaire are the three data collection techniques that I used for this study. I asked participants to respond to the same interview questions; however, face-to-face and telephone interviews enabled me to ask probing questions. The location for the individual semistructured interviews was the company's location or via phone based on the convenience of the participant. The focus group took place at the company's location in a private conference room. I administered questionnaires to participants via e-mail.

After the data transcription, I conducted member checking. Member checking is a way to help ensure validity and agreement on responses to research questions (Birt et al., 2016; Caretta & Pérez, 2019). I sent participants a summary of their interview responses to ensure that I correctly interpreted their responses. I asked participants to return any updates or corrections within 2 days after receipt of the transcribed responses. I also indicated that no response infers acceptance of summary of the transcribed responses.

Data Organization Techniques

I used audio recordings and notes to document participant responses. The data collected from the focus group were recorded, transcribed, and uploaded into Microsoft Excel software for analysis, the identification of themes, and coding. I used USB drives to securely encrypt audio recordings. I will destroy the USB drives after 5 years using a data destruction program. After transcription, I used member checking to provide participants an opportunity to review, validate, and make corrections to their responses to the research question. The period for member checking was 2 days. Data collection

through the focus group took 1 day. All participants provided a signed consent form to take part in the study. Figure 3 refers to the process for data collection and analysis.

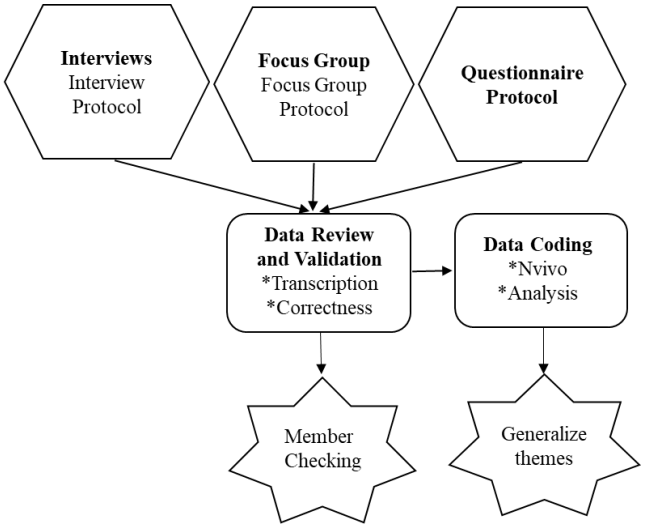

Figure 3. Protocol for use during data collection and analysis.

Data Analysis

Data analysis is the process of describing, classifying, and connecting phenomena with the researcher question (Graue, 2015; Mayer, 2015). For data analysis, I used methodological triangulation and thematic analysis. Methodological triangulation enables the researcher to bring together data from two or more sources to report a wider collection of sequential and social problems (Cypress, 2018). Connecting the sources of data to the research question is one of the most compelling reasons for using methodological triangulation. The use of methodological triangulation also aides in controlling researcher biases and enables the establishment of useable themes (Cope, 2014; Leedy & Ormrod, 2015; Sarma, 2015; Yin, 2018). For this study, I used (a) semi-structured interviews with six leaders of LSS projects, (b) a focus group of five leaders, and (c) a questionnaire from six leaders.

Thematic analysis is the identification of all data that relates to the classifications that exist in the study. The process of thematic analysis involves the coordination of similar data identified in related categories identified in the data (Aronson, 1995). Yin (2018) proposed a five-step approach to conducting qualitative data analysis: (a) compiling, (b) disassembling, (c) reassembling, (d) interpreting, and (e) concluding for this research study. I used Yin's five-step approach to conduct data analysis for this study.

Compiling

Castleberry and Nolen (2018) indicated that a researcher needs to compile the data collected from interviews and focus groups into a format to find important responses to research questions. The data must first be transcribed which can be accomplished by the researcher or outsourced to a company that handles transcription. According to Cypress (2018), personal transcription of the data enables a researcher to obtain greater familiarity with the data before transitioning to the disassembling step. Personal transcription of the data also enables the researcher to make notes and memos in the margins during the transcribing phase to assist in coding the data. The transcribed responses to the interview questions and focus groups are securely stored on digital files using the specific naming convention. I captured the individual interview data and focus group session data using audio recorders. The benefit of audio recording the interview and focus group sessions is that it provides a way to review the data sessions repeatedly in preparation for analysis (Saunders et al., 2015). I personally compiled and transcribed

the data collected into individual word documents and compiled those documents in Excel. I also made notes during transcription to capture relevant thoughts.

Disassembling

Researchers can separate or disassemble the data once the data is documented, compiled, and organized (Castleberry & Nolen, 2018). Disassembling refers to the process of taking the data apart to identify common meanings or themes to codes (Castleberry & Nolen, 2018). Within qualitative research, coding is the process of identifying similarities or differences within the text and transforming the data collected into themes (Castleberry & Nolen, 2018; Cypress, 2018). Coding can also be predetermined particularly in cases where prior research exists (Castleberry & Nolen, 2018; Cypress, 2018; Graue, 2015; Mayer, 2015). Castleberry and Nolen (2018) indicated that a researcher defines the coding which can be descriptive labeling that indicates a process or action or emergent theme from the transcribed text. A researcher identifies coding based on occurrences of what, how, when, and where, and the inferences for why something is happening as it pertains to the research question. When no new themes emerge from the text, a researcher can be confident about the coding structure. I utilized coding to categorize emergent themes identified within the data.

Reassembling

The reassembly step involves the process of making the connections that are significant for use in determining explanations from the data (Castleberry & Nolen, 2018). Forming the explanations will enable deeper insights into meanings within the data (Bansal, et al., 2018; Castleberry & Nolen, 2018). During the reassembling step, the

researcher can reduce the number of themes to as few as five or six themes (Castleberry & Nolen, 2018). I assessed the coded data to combine similar meanings to achieve broader meanings or an idea.

Interpreting

Comparing and validating the data during the interpretation step is significant for conducting analysis (Castleberry & Nolen, 2018; Cypress, 2018). According to Castleberry and Nolen (2018), during the interpreting step, the interpretations should be complete, fair (meaning other researchers should come to the same interpreted conclusion), representative of the data collected, be within the context of the current literature, and credible. Some researchers utilize graphics or a thematic map to represent the themes, codes, and their relationships (Castleberry & Nolen, 2018). I incorporated the use of graphics to demonstrate themes, codes, and their relationships.

Concluding

The final step in the process is drawing conclusions that are the findings from the study. The report on findings included the processes used for the research. The data analysis will conclude with the preparation of a research report that consists of five areas (Leedy & Ormrod, 2015). Elements of the data are in the form of figures and tables as well as discussions (Cypress, 2018). For this study, my research report restated the specific intent of the study and explained how the findings contributed to the existing body of knowledge within the first area. Within the second area, I described the facts involved in the research study, including the setting and participants. The third area consisted of a description of the data collected from the individual interviews, focus

group, and a questionnaire. The analysis and consolidation of understandings of the data collected encompassed the fourth area. For the fifth area, I connected the findings to the research question and the theoretical model. The process of data analysis consisted of preparing and organizing the data, reduction of accumulated data to a manageable size, and the analysis and interpretation of the data.

Cypress (2018) and Yin (2018) indicated that an alternative for manual data analysis includes the use of computer-assisted tools. The computer-assisted tools do not conduct data analysis for the researcher but provide the researcher with an efficient way of coding and categorizing data. Cypress (2018) and Sinkovics and Alfoldi (2012) noted that the use of computer-assisted qualitative data analysis software (CAQDAS) or computer-aided software or interpretive software is important for conducting qualitative analysis. Software such as Microsoft Excel and Microsoft Word Cloud are examples of a computer-assisted tool. I highlighted visible themes within the compiled data using Microsoft Excel.

Leedy and Ormrod (2015) indicated that the narrative approach for summarizing the findings of a case study involve connecting themes, categories, and diverse perspectives of the participants. Data analysis concluded with the preparation of research findings that typically include a restatement of intent, facts involved in the research, data collection description, analysis and consolidation of understandings, and the connection of the findings to the research question and conceptual framework. In the final report I included a restatement of the intent of the study and an explanation of how the findings contribute to the existing body of knowledge.

Reliability and Validity

The four pillars of qualitative research are credibility, dependability, transferability, and confirmability. Credibility and dependability indicate that the data collected are generalizable for future studies and are practical in work environments (Cope, 2014). I used various methods to ensure the qualitative research study is reliable and valid.

Dependability is important for qualitative case study research. The ability to follow or repeat a documented research process demonstrates dependability (Garside, 2014; Yin, 2018). Dependability indicates that the documented steps involved in a research process can serve as a guide for future research and produce the same results (Elo et al., 2014; Yin, 2018). Yin (2018) also noted that the objective of ensuring dependability is to reduce the occurrences of errors and bias. For this study, participants must have at least 3 years of experience with the phenomenon.

Establishing credibility involves incorporating data triangulation and member checking (Birt et al., 2016; Candela, 2019). The triangulated data sources included interviews, a focus group, and a questionnaire. Triangulation involves bringing together data from two or more sources to report on a wider collection of sequential and social problems. Connecting the sources of data to the research question is one of the most compelling reasons for using triangulation. Though Mayer (2015) indicated that critics of triangulation contend that data from different sources are not comparable, other researchers indicated that the use of triangulation also aids in controlling researcher biases and enables the use of useable themes (Cope, 2014; Leedy & Ormrod, 2015;

Mayer, 2015; Yin, 2018). I also used member checking to give participants the chance to review the transcribed data from their interviews and to affirm the interpretation of the data or make changes, if desired. Member checking helps ensure validity of the data collected (Birt et al., 2016; Candela, 2019; Cope, 2014).

Transferability refers to meanings from research that are applicable and repeatable in other studies that are similar (Amankwaa, 2016; Hays, Wood, Dahl, & Kirk-Jenkins, 2016). Cope (2014) and Garside (2014) also noted that transferability in qualitative research is apparent when findings about the phenomenon are generalizable and applicable to other groups or organizations. Amankwaa (2016) indicated that a way to achieve transferability is through thick description. Researchers incorporate thick description to acquire greater insights into a phenomenon (Sallee & Flood, 2012). Researchers should provide enough detail of a phenomenon so that others can effectively evaluate the data to determine their fit to other circumstances (Amankwaa, 2016). I incorporated the use of thick descriptions within the interview questions and the questionnaire.

Confirmability refers to the honesty and accuracy of findings in relation to the participants' experiences or beliefs within a study that are without bias from the researcher. Triangulation and member checking are also methods for achieving confirmability and credibility (Amankwaa, 2016; Birt et al., 2016; Cope, 2014). I disclosed details regarding the sources and research protocol used during the study to address confirmability.

Although researchers debate when data saturation is achieved in qualitative research, data saturation occurs when the data collected is redundant (Hagaman & Wutich, 2017; Hennink et al., 2019; Lowe et al., 2018; Saunders et al., 2015; Weller et al., 2018). The researcher determines the point of data saturation (Saunders et al., 2015). I achieved data saturation with the initial sample.

Transition

Within Section 1, I presented the problem statement and purpose of the study to explore the aerospace industry, the associated research and interview questions, the conceptual framework, the significance of the study and its social impact, and a review of relevant academic and professional literature related to this study. In Section 2, I presented the project research and design, my role as the researcher, qualifications for participants, population, and sample, requirements for ethical research, and criteria for data collection, analysis, and validity. In Section 3, I present the findings of the study, application to professional practice, implications for social change, recommendations for action and further research, and a reflection on my experience within the doctoral study process.

Section 3: Application for Professional Practice and Implications for Social Change

Introduction

The purpose of this qualitative single case study was to explore the successful strategies that LSS project leaders use to mitigate project costs in manufacturing. I collected data from semistructured face-to-face and virtual interviews, a focus group, and questionnaires from aerospace manufacturing leaders in the southeastern and northwestern regions of the United States who successfully implemented LSS project strategies to mitigate project costs. The analysis of the data collected resulted in the emergence of four themes: preparation, objectives, robust training, and collaboration. Several participants indicated that preparation involving an LSS-certified expert (internal LSS Green or Black Belts and external consultants) is critical to Lean Six Sigma project leadership. Participants also stated that an understanding of the objective and LSS training are critical for determining successful LSS strategies. In addition, participants stated collaboration between the LSS project leaders and the impacted organization is a critical aspect of LSS strategies. The findings from this study could provide project leaders with strategies that help to reduce project costs.

Presentation of Findings

The overarching research question for this study was as follows: What successful strategies do LSS project leaders use to mitigate LSS projects' costs? I conducted semistructured face-to-face and virtual interviews and a focus group, and I collected completed questionnaires to gather data from aerospace manufacturing leaders in the southeastern and northwestern regions of the United States who successfully

implemented LSS projects strategies to mitigate project costs. Table 3 reflects the demographics of the sample population represented by code names.

Table 3

Demographics of the Population

Participants	Years of LSS project experience	LSS certification(s)	On-the-job or other LSS training
FG01	3	White Belt	On the job
FG02	30	None	Government/military
FG03	7	Green Belt/Black Belt	American Society of Quality
FG04	4	None	On the job
FG05	7	None	On the job/external consultants
IP01	10	None	On the job
IP02	10	None	On the job
IP03	13	None	On the job
IP04	17	Green Belt	On the job
IP05	14	None	Trade school/on the job
IP06	15	None	Classroom/on the job
QP01	6	None	Online/on the job
QP02	15	None	External/on the job
QP03	15	Green Belt/Black Belt	On the job
QP04	11	None	On the job
QP05	12	Green Belt	Self-study

The research question was the basis for the data collection process, and the research design was an exploratory case study using a qualitative methodology to gain insights through the experiences of the participants. A qualitative case study was suitable for this study to explore features within the complexity of the phenomenon in a real work environment. I used a sample to identify leaders in the United States who were at least 21 years of age, fluent in English, and had at least 3 years of experience with LSS projects. The sources of data used to explore the phenomenon were a focus group, individual interviews, and a questionnaire.

I assigned participants of the focus group, interviews, and questionnaire code names during the data collection process to ensure anonymity. The code names for the focus group participants were FG01 through FG05. The code names for the questionnaire participants were QP01 through QP05. The code names for the interview participants were IP01 through IP06. I transcribed the data into an Excel workbook and organized the data by participant code and question.

Table 3 reflected the demographics of the sample represented by code names. The code name prefix FG was for the focus group participants, IP was for individually interviewed participants, and QP was for participants who completed a questionnaire. Each code included a two-digit number that represented individual participants within each data collection set.

For triangulation analysis, I used three sources of data collection to explore the phenomenon and reviewed financial documentation that showed the mitigation of project costs and observed documents where the participants mitigated project costs. Yin (2018) posited that findings within a case study are more convincing if supported by triangulating data. Leedy and Ormrod (2015) indicated that triangulation is a common practice in qualitative research that enables researchers to produce themes from analyzed data. I compared the data collected from each source to identify information that addressed the research question.

The analysis of the data collected also resulted in the emergence of four themes: (a) preparation, (b) objectives, (c) robust training, and (d) collaboration. Several participants indicated that preparation involving an LSS-certified expert (internal LSS

Green or Black Belts and external consultants) is critical to LSS project leadership. Participants also stated that an understanding of the problem and LSS training is crucial to determining successful LSS strategies. Furthermore, the collaboration between the LSS project leaders and the impacted organization is a critical aspect of LSS strategies. The findings from this study could provide project leaders with strategies to mitigate project costs.

Theme 1: Preparation and Tool Selection

Business leaders who do not adequately prepare for LSS projects are at risk of increasing project costs. Lizarelli and Alliprandini (2020) noted that business leaders struggle to conduct LSS projects. Preparation before starting LSS projects is essential to implementing LSS projects and mitigating project costs (Asmae, Abdelali, Youssef, & Brahim, 2019). Asmae et al. (2019) indicated that business leaders must include preventive maintenance and corrective maintenance as part of their preparation to prevent higher project costs. The first emergent theme from this study was that preparation before starting an LSS project is critical for mitigating project costs. Preparation includes engaging an LSS expert and selecting the right LSS project tools.

FG01 indicated that, on his successful LSS project, “We had a project manager who had a black belt set up everything. He set up the people into teams and we held brainstorming sessions as part of our planning. This was my introduction to LSS.” FG04 and FG05 worked on an expansion project to set up a new facility in a southeastern state to increase value and reduce customer costs. The project lasted approximately 3 months and included developing production lines, systems, and processes. FG05 indicated that

management supported the project entirely and that failure was not an option. The basis for LSS tool selection on the expansion project was the purpose of the project. Although FG04 and FG05 differed in years of experience, they concurred on their descriptions of LSS tools. Participants FG04 and FG05 indicated that they had clear objectives and specific requirements to achieve in setting up the new site, including low inventory, which made the selection of the right LSS tools essential. Project engineers with LSS certification and experience selecting LSS tools guided the team on tool selection at the onset of the project. The engineers talked through the options for LSS tools based on requirements the team had to achieve. Also, a cross-functional team provided support and guidance for all aspects of the project, which was critical for mitigating project costs.

Participant FG05 commented that the initial LSS tools identified for the project included brainstorming, value-stream maps, five whys, and fishbone diagrams. FG05 stated,

> Clarity in the objectives of the project was critical to enabling the team to select brainstorming as an initial LSS tool at the start of the project. Value-stream mapping enabled the team to lay out the design of the facility based on information obtained from brainstorming. The team also selected five whys and fishbone diagrams to resolve issues throughout the project. Other tools identified for the project by the certified LSS participants included process flow charts, spaghetti diagrams, and error proofing. The certified LSS expert suggested using the 3P process tool at the onset of the project, but it was difficult for the team to

understand how to use the tool. Without preparation for the project, it would not have worked.

IP02 stated, “At first we fumbled pretty good, but once we brought in the contractors that were LSS Black Belt experts that guided us on the right path, we have been going strong ever since.” Participants IP03, IP05, and IP06 stated that their LSS certifications contributed to their LSS tool selections for mitigating project costs. Participant FG01 responded, “An LSS Black Belt led his project and additional LSS project team consultants from another country also worked on the project to ensure a successful outcome.” Figure 4 reflects Theme 1.

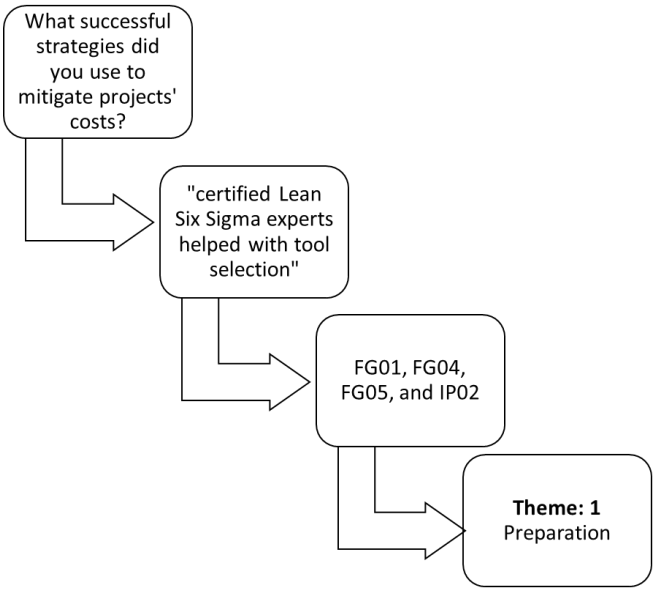

Figure 4. Theme 1: Preparation.

Theme 1 was the emergent theme based on the descriptions of how to select LSS projects that required business leaders to ensure certified LSS experts were part of the project team. The participants, particularly within the focus group and interviews, indicated that including LSS-certified experts, internal LSS Green and Black Belts and

external consultants, is critical to LSS project leadership. Participants felt that the knowledge base encompassed by the LSS-certified experts provided LSS teams with the appropriate setup for projects and guidance on the appropriate tool selection and application based on project objectives. Participants also indicated that the LSS expert based the selection of tools on the objectives of the project.

Preparation is an emergent theme that aligns with the current literature. Albliwi, Antony, and Abdul halim Lim (2015) indicated that some leaders lack information on how to mitigate high project costs. Preparation as a theme supported the inclusion of an LSS-certified expert on projects. Walter and Paladini (2019) and Mustapha, Fauziah, and Muda (2019) noted that certified LSS experts, such as LSS Black Belts, provide coaching to participants of a project from the onset of the project and in support of mitigating project costs. Also, Walter and Paladini (2019) and Alexander et al (2019) noted there must be preparation or a strategic road map during the planning phase for change, which includes communicating the need for the change throughout the organization and support by senior leaders; otherwise project costs increase.

Theme 1 is a strategy for mitigating LSS project costs and is consistent with the theory of constraints. Wu, Zheng, and Shen (2020) noted that the initial step in the theory of constraints is identifying and focusing on the constraint. Garza-Reyes, Villarreal, Kumar, and DiazRamirez (2019) indicated that business leaders use the theory of constraints to identify weaknesses within their processes and practices. Business leaders use the theory of constraints to understand change and identify improvements. Similarly,

participants in this study indicated that the initial step in conducting LSS projects is preparation, which includes identifying and focusing on constraints within processes.

Theme 2: Objectives

Business leaders who do not ensure LSS project objectives are clear and understood by the team also risk increasing project costs. Clearly understanding objectives before the start of an LSS project is critical to mitigating LSS project costs (Antony et al., 2019). Project objectives have a direct correlation to selecting the right LSS tools and methods to achieve problem solving and root cause analysis (Antony et al., 2019; Lizarelli & Alliprandini, 2020). Three focus group participants, an interview participant, and a questionnaire participant discussed the importance of this theme.

Participant FG01 said the following,

> Based on previous LSS experience, I knew what tools I was going to use based on what that problem was. I then knew what it would take to reach the goal either through cost analysis or the labor costs that we were going to save as a result of the project.

Participant FG04 stated,

> When we worked on the expansion project, using LSS processes and methods, we knew what the problem was and we had a lot of historical data to know how much time it was taking to do this job. We were shipping our products across the US to customers, and it was expensive. With this project, we moved our factory closer to our customers, eliminated wastes in our production, and cut down the transit time from our process, which was huge for reducing costs.

Participant FG05 stated the following,

> I am going to add on and expand on what FG04 talked about because it was the same project. We were tasked with the decision to open an expansion facility. That required not only going through and coming up with what the production line and systems were going to be but also work out the process systems as well--the support piece of this. This project was something the company had not done before. We had a clear objective and knew what we wanted to create, which was one-piece flow. We were structured in cross-functional teams. We identified everything that we considered a concern using error-proofing and many other LSS tools like brainstorming, 3P process, process flow chart, value steam mapping, and spaghetti diagrams.

Participant IP05 discussed the importance of LSS project objectives using a prior project for a cell design, and a LSS workbook as a guide. IP05 stated the following,

> The very first step of any cell design should be analyzing the demand. The next step was to understand how material flows and make early decisions regarding line feeding and material handling needs. LSS encompasses methods and tools to use within each step. The use of the workbook to achieve objectives eliminates the potential for selecting the wrong LSS tools.

Participant QP05 offered the following perspective that objectives are driven by desired results, “LSS encompasses the tools to design, analyze, and maintain your business system using statistical data and controls. My understanding is that LSS tools are selected based on the results you expect to achieve.” Figure 5 reflects Theme 2.

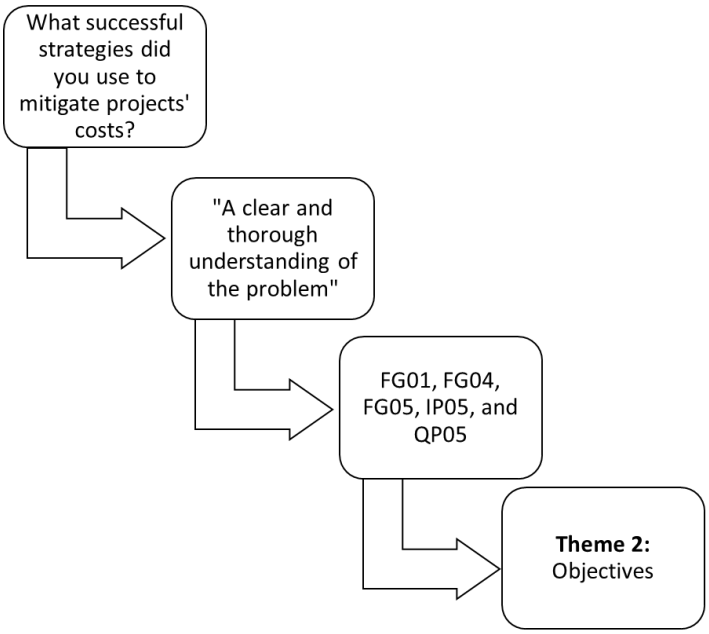

Figure 5. Theme 2: Objectives.

Clear understandable objectives were an emergent theme that aligns with existing literature. Theme 2 reflected that business leaders must ensure there is a clear and thorough understanding of project objectives so project teams can select the appropriate LSS tools to achieve cost savings and mitigate project costs. Participants within the focus group and interviews frequently indicated that they knew what they had to do or that they understood the problem and the problem was the basis for LSS tool selection. Albliwi et al. (2015) posited that selecting the wrong LSS tools prohibits cost savings and can result in increased project costs. According to Antony et al. (2019), Sreedharan V, Sunder M, Madhavan, and Gurumurthy (2019), and Uluskan (2019), the basis for LSS tool selection stems from the objective of the project, and each LSS tool has a specific purpose designed to address a variety or combination of problems. Within this study, objectives were a constraint for mitigating LSS project costs and were consistent with the theory of

constraints. Wu et al. (2020) noted that a focusing step in the theory of constraints is determining what the constraint is and how to exploit it. Garza-Reyes et al. (2019) indicated that the theory of constraints is predicated on the understanding of what is being changed or the objective. As in the theory of constraints, participants in this study indicated that a focusing step in conducting LSS projects is having clear objectives before starting a project.

Theme 3: Training

Business leaders who do not employ training for LSS project teams risk increasing project costs. The third emergent theme from this research was training. Understanding the relationship between a project and LSS tool selection requires training. LSS training should encompass robust LSS curricula that prescribe tool selection (Antony et al., 2019; Lizarelli & Alliprandini, 2020; Mustapha et al., 2019; Uluskan, 2019). Participants from the interviews and questionnaires identified their personal training experiences that included self-study, on-the-job training, and formal certification courses. The participants also reiterated that employing the skills of LSS experts is essential and that training for employees should focus on using and applying LSS tools.

Participant IP02 stated,

> In addition to taking formal LSS training courses, I have a reference that I use from my training courses called the Green Belt handbook to help with the identification of LSS tools for my projects. I also use consultants to get started on LSS projects, and I hired an LSS black belt to work on site. I enlisted a

> combination of strategies to ensure that we properly prepare for each LSS project and to ensure successful project completion.

Participant IP01 stated, “It is important to maintain LSS resource materials and handbooks from LSS training to use as a reference.” Participant IP03 indicated the following,

> I received on-the-job training, which consisted of classroom training and project execution. Certification came after meeting requirements for projects worked, and along with the training, there are a variety of LSS tools that were included in a playbook. My training enables me to first identify the problem, organize the problem, and then plan for the proper LSS tools to address the problem. I also look at quality and other data that help me to make decisions on what LSS tools to use.

Participant IP05 indicated the following,

> Once I got into the aerospace industry, I gained more practical use of LSS tools. I was a manufacturing process engineer, and that helped me obtain the opportunity to go to formal LSS training and work on implementing some LSS projects. Within my current corporation, LSS is much more part of the culture. We have done some projects that are moving up in importance and significance to the business. I will get my largest career rewards because of the LSS training I received.

Participant QP02 responded with the following,

Training provided a curriculum that also prescribed a standard set of LSS tools to use in completing standard work and cell design. The training included an Excel workbook that walked individuals through each step and the specific tools needed to complete each task. My company is committed to LSS at all levels of the organization and requires every employee to gain at a minimum, a Lean Associate degree, and has eliminated the potential for selecting the wrong tool by creating this standardized curriculum.

Figure 6 reflects Theme 3.

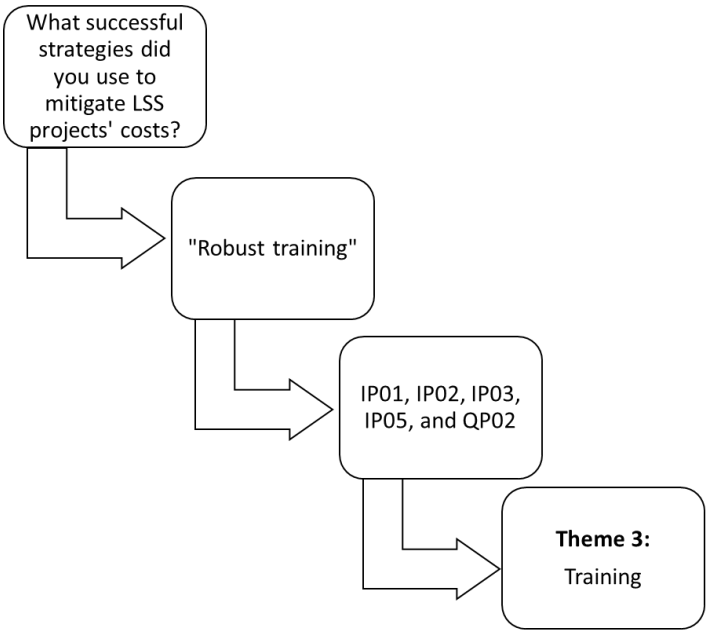

Figure 6. Theme 3: training.

Theme 3, robust training for employees, has a significant impact on the ability to approach selecting the right LSS tools and mitigate project cost. Training geared toward selecting tools based on project objectives was an essential part of the training curriculum by participants. Training was an emergent theme that aligns with current literature.

Researchers should shift from looking at the benefits of using specific LSS tools to gaining an understanding of how to select and use LSS tools to mitigate project costs (Amin & Karim, 2013; Uluskan, 2019).

Within this research, training was a constraint for mitigating LSS project costs and consistent with the theory of constraints. Modi, Lowalekar, and Bhatta (2019) indicated that the theory of constraints provides business leaders an approach to mitigating costly constraints within processes. Martínez León (2019) noted that most employees entering new organizations have significant training but lack the knowledge to integrate theoretical concepts that are critical to success with continuous improvement methodologies like LSS. Training in how and why specific tools are used is necessary for mitigating project costs.

Theme 4: Collaboration

Business leaders who do not ensure a collaborative environment for LSS projects also risk experiencing an increase in project costs. A critical component of mitigating LSS project cost is support and commitment from leadership and employees (Antony et al., 2019; Stankalla, Koval, & Chromjakova, 2018). Leadership commitment ensures the prioritization of goals and the commitment of resources (Alexander et al., 2019). All participants from the focus group, interviews, and questionnaires concurred that collaboration with management, the LSS project team, and the impacted organization are essential aspects to mitigating project costs.

Participant FG03 stated,

> LSS tools drive effective, sustained improvement. Management support, commitment, and allocation of resources are critical factors for an LSS project. As I am a certified ASQ six sigma black belt, I am capable of successfully using different sets of LSS tools to mitigate projects' cost and achieve cost savings. Including and engaging the shop, people will lend an advantage to implementing any LSS project. Without the support of management, I could encounter a multitude of risks that would increase projects' costs.

Participant IP05 stated,

> Cost savings are more achievable and sustainable with the right leadership and management support. Then the right application of LSS tools enables cost savings and mitigates projects' cost. If it is a collaborative project, the LSS tool selections are driven by the information and results that the leadership and the project team want to see. Precursors to mitigating increased projects' costs include the right environment, leadership commitment, and a clear purpose or objective for the project to know how and where to apply the LSS tools. Also, understanding managements' interests promote support of the project as well as the sustainability of the project outcomes.

Participants IP05 and QP03 also indicated that management support enables open communication with the people who do the work and whom the project will affect. Open communication also provides workers an opportunity to convey their issues. Participant QP01 stated,

Management support, group involvement, and buy-in, communicating the problem on the objectives, and being allotted sufficient time and resources are needed to accomplish the project to completion and mitigate projects' cost. Also, respect for the people who do the work and seeing them as important contributors to the business is critical to LSS project outcomes and sustainability.

Figure 7 reflects Theme 4.

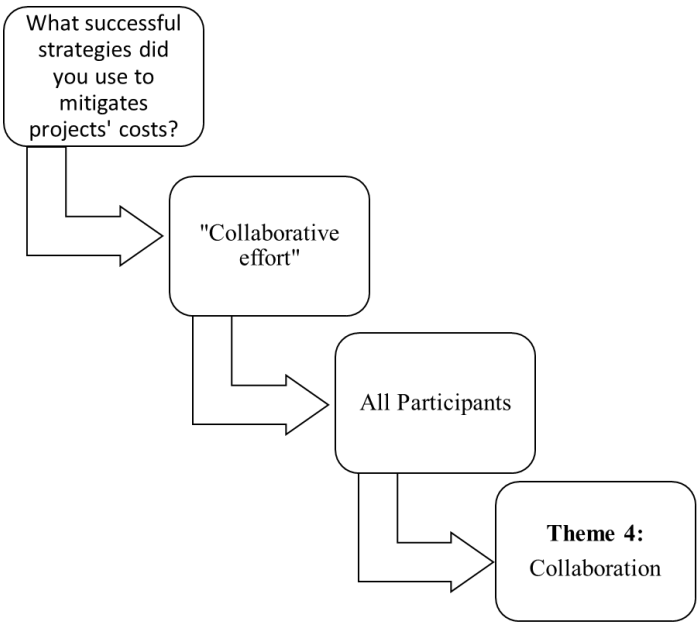

Figure 7. Theme 4: Collaboration.

Collaboration is necessary to ensure LSS projects have support. Theme 4 was the emergent theme based on the participants' descriptions of collaboration with management and individuals who work in the area affected by the project. Participants indicated that the support of management ensures resources are available for projects. Participants also noted that the impacted organizations or areas that a project is intended to improve should have a working knowledge of the existing function that enables them to provide input on decisions or outcomes for the planned project. Participants also seemed passionate when

discussing the inclusion of the impacted organization and recognizing the people and their contributions as valuable.

Collaboration was the fourth emergent theme that aligns with current literature. Čiarnienė and Vienažindienė (2012) indicated LSS should incorporate a plan for change that includes teams from multiple organizational functions and management that must work together to achieve project objectives. Laureani and Antony (2019) indicated that collaboration with leadership on LSS projects is a top driver in mitigating LSS project costs. Similarly, Mustapha et al. (2019) noted that leadership serves as the champion for LSS projects and the project teams often consist of LSS trained personnel including White, Yellow, Green, and Black Belt LSS experts and the employees impacted by the change. Antony et al. (2019) indicated that leadership must ensure the communication and engagement of employees on the LSS project objectives to achieve collaboration.

Collaboration is a constraint for mitigating LSS project costs and is consistent with the theory of constraints. Garza-Reyes et al. (2019) showed that a constraint in a process that causes a bottleneck within the entire production chain. Bottlenecks result in stalled production, customer dissatisfaction, and low employee morale. The theory of constraints incorporates the importance of collaboration that encompasses the entire production chain, often with using a formal agreement during project preparation. Like theory of constraints, participants indicated that collaboration helps business leaders mitigate projects' costs.

The findings for this study revealed four major themes from the data collection: (a) preparation, (b) objectives, (c) training, and (d) collaboration. The themes represent

the strategies business leaders use to mitigate project costs. Figure 8 reflects the integrated themes for successful LSS project strategies. The emergent themes are constraints and therefore consistent with the theory of constraints.

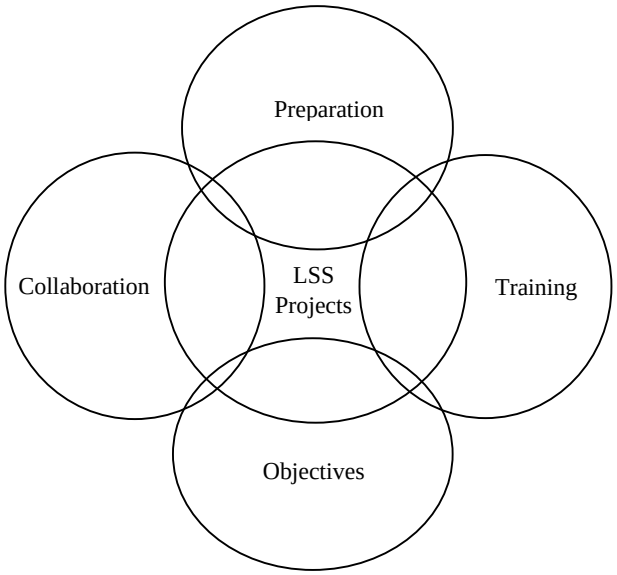

Figure 8. Themes for LSS project cost mitigation.

Although leaders in many companies embrace LSS, there is often disappointment when LSS projects do not render cost savings (Antony & Gupta, 2019; McLean, Antony, & Dahlgaard, 2017; Sony, Naik, & Therisa, 2019; Sreedharan V, Gopikumar, Nair, Chakraborty, & Antony, 2018). To address the research problem, I contacted 16 leaders of LSS projects who had successfully implemented LSS projects and mitigated project costs. The research contributed to the business problems by supporting the literature on LSS and the importance of using successful LSS project strategies.

Theme 1, preparation, was an emergent theme that aligned with existing research conducted by Albliwi et al. (2015) that indicated leaders lack information on how to start projects. The theme of preparation supported the planning and inclusion of an LSS-

certified expert on projects. Walter and Paladini (2019) and Mustapha et al. (2019) noted that certified LSS experts, such as LSS Black Belts, provide coaching to team members from the onset of a project through project completion.

Objectives was the second emergent theme. This theme aligned with recent research conducted by Antony et al. (2018), Raval, Kant, and Shankar (2019), and Sreedharan V, Sundar, et al. (2019) that indicated clear project objectives are necessary to ensure the selection of the right LSS tools. As noted in Section 1, Denning (2011) indicated that leaders often use common sense or best judgment in the selection of LSS tools, as opposed to objectives or a logical approach. Lizarelli and Alliprandini (2020) and Raval et al. (2019) indicated within their research that LSS projects can fail without strategic objectives.

Theme 3, training, aligned with recent research on the importance of providing training for managers and project teams geared toward understanding LSS tools and techniques in efforts to mitigate project cost (Sreedharan V, Sundar, et al., 2019). In recent studies, researchers indicated that a lack of training for project teams and leaders could result in project failures (Antony et al., 2019; Sreedharan V, Sundar, et al., 2019; Walter & Paladini, 2019). Participants in this study indicated that robust training helps project teams make the connection between tool selection and project objectives. Alexander et al. (2019), Shokri and Li (2020), and Uluskan (2019) indicated that training is essential, particularly for statistical tools at the onset of a project. Training enables higher performance for LSS project teams.

Theme 4, collaboration, aligned with research conducted by Albliwi et al. (2015) and Čiarnienė and Vienažindienė (2012), who emphasized the importance of management involvement and commitment for LSS project teams. Recent research by Antony et al. (2019), Laureani and Antony (2019), Mustapha et al. (2019), and Walter and Paladini (2019) indicated that business leaders must carefully consider the right combination of elements for LSS projects that include the involvement and engagement of employees on LSS projects and management. The theory of constraints relates to collaboration from an engagement perspective. Participants in this study indicated that collaboration with leaders and those affected by a project help to mitigate project costs.

Application to Professional Practice

The specific business problem was that some LSS project leaders lack strategies to mitigate project costs (Albliwi et al., 2015; Amin & Karim, 2013). The themes that resulted from this study apply directly to professional practice and could help business leaders develop strategic plans or a road map to set up their LSS projects and mitigate costs. Alexander et al. (2019), Antony, Gupta, Sunder M, and Gijo (2018), Sreedharan V, Raju, Sunder M, and Antony (2019), and Walter and Paladini (2019) showed that there must be a strategic road map in the planning phase for LSS projects to mitigate project costs. One practical aspect of the themes within this study for LSS strategies is that business leaders can take advantage of employees or consultants with LSS-certified expertise to set up and provide guidance to LSS project teams. Also, leaders of LSS projects need to ensure employees have specific LSS training that incorporates LSS tools selection and application before setting up the project. The findings of the study further

highlighted that business leaders are the ambassadors of LSS projects. Business leaders must ensure collaboration by actively engaging with project teams to ensure resources and support are provided to mitigate project costs (Laureani & Antony, 2019; Sony et al., 2019; Walter & Paladini, 2019).

Implications for Social Change

Business leaders of organizations that mitigate project costs may also contribute to social change by funding social enterprises. Increased funding for social enterprises could help to reduce poverty, unemployment, and homelessness within the communities in which they operate. The results of this study may indirectly support social change by providing successful strategies that help business leaders improve the success rates of LSS projects, mitigate increased project costs due to failures, and achieve cost savings. The research also contributes to the body of knowledge on LSS implementation strategies and provides a platform for further research on this topic within the scholarly community.

Recommendations for Action

The purpose of this qualitative, single case study was to explore the successful strategies that LSS project leaders use to mitigate project costs. Globalization has created a volatile environment that requires business leaders to use continuous improvement strategies such as LSS to provide products and services faster and more efficiently. The four themes that emerged from this study were (a) preparation, (b) objectives, (c) training, and (d) collaboration. The findings should be of interest to business leaders responsible for LSS projects as strategies to help mitigate LSS project cost, drive efficiencies, and achieve cost savings.

Recommendations for action are for business leaders to incorporate the four themes into their plans for conducting LSS projects. Business leaders must prepare for LSS projects. Such preparation should include an LSS expert or an employee trained in LSS to help set up and coordinate the project to address the problem. Business leaders must also clearly identify, communicate, and document the objectives of the LSS project and ensure the project teams receive LSS training. The approach to implementing LSS projects must encompass collaboration. Collaboration entails commitment from organizational leaders in supplying resources and those impacted by the impending change.

To distribute the findings of this study to help business leaders improve the knowledge of strategies for LSS project, I will use two approaches. I will publish the contents of the approved research study in the ProQuest dissertation database so interested business leaders, scholars, and students will have access to the published research study. I will also provide a copy of the summary of the study findings to the business leader who granted me access to the case study organization for distribution to the study participants. My goal is to continue to increase my knowledge of LSS and identify practical applications in my workplace as well as train doctoral students on LSS and project management.

Recommendations for Further Research

A recommendation for further research is conducting more in-depth research on the findings, specifically the application and use of LSS tools. One of the most significant research findings was the connection between project objectives and selecting the right

LSS tools. Further research on these topics could provide more understanding on selecting the right LSS tools. Also, future researchers should consider conducting more in-depth research on elements of critical success and failure factors in various industries.

A limitation for this study described in Section 1 was a single case manufacturer within the aerospace industry in the southeast region of the United States. Future researchers should consider expanding the findings using multiple businesses and industries to improve the generalizability of the findings. Other considerations for future researchers include businesses within other domestic and international locations. Also, I was subject to a time constraint. Future researchers may consider conducting this study over a more extended period.

The themes identified through data analysis indicated that planning, objectives, robust training, and collaboration are elements needed for mitigating LSS project costs. The findings also supported the literature by showing that multiple elements are significant for LSS project strategies. Future researchers should consider conducting a more in-depth exploration of these factors.

Reflections

Completing the doctor of business administration program has been a long and arduous journey. I was working full-time in an uncomfortable environment, and the company faced unusual challenges that resulted in the doctoral journey being even more challenging but also more desired. I had the opportunity to conduct a focus group and interviews with individuals whom I would not have typically met, and I was able to learn about their unique roles and experiences. All the interviews and the focus group went as

planned. Though I received 100% of the completed questionnaires, I had a more difficult time obtaining responses from questionnaire participants within the time frame requested.

Conclusion

Business leaders use LSS to conduct process improvements, remove waste, lower production costs, provide value to consumers, and achieve cost savings for a competitive advantage; however, excessive LSS costs can place manufacturing businesses at a competitive disadvantage. Approximately 70% of LSS projects fail and can significantly increase project implementation costs. Some LSS project failures occur because leaders lack the strategies needed to mitigate project costs. The purpose of this qualitative, single case study was to explore the insights and experiences that successful strategies business leaders use to mitigate project costs. I used individual interviews, a focus group, and a questionnaire to collect descriptions of the strategies business leaders use to mitigate LSS project costs. The four emergent themes from the study were (a) preparation, (b) objectives, (c) training, and (d) collaboration. I performed thematic analysis and related the findings to the existing literature and the theory of constraints, which served as the conceptual framework for this study.

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Appendix A: Call for Participants

To: Lean Six Sigma Leaders and Team Members (past and present)

Please consider sharing your experience through participation in an academic research project. Past and present leaders and team members with at least three years of Lean Six Sigma project experience required. Please reply within three days of the sent date of this email by selecting Response 1 or Response 2 explained below:

Response 1:

- I would like to participate in an individual interview (can be virtual), a focus group held in North Charleston, SC or respond to a questionnaire to share my experience with Lean Six Sigma projects.
- I am at least 21 years of age and I have at least three years of experience with Lean Six Sigma projects and Lean Six Sigma tools.
- I have also attached my contact information and my personal background with Lean Six Sigma projects for the researchers' consideration.

Response 2:

- No thanks, I will not participate.

Purpose of the Study:
The purpose of this qualitative single case study is to explore the successful strategies that LSS project leaders use to mitigate projects' costs within manufacturing.

Requirements for Participation in the Study:
Potential participants must be at least 21 years of age. In addition, potential participants must have at least three years of experience on Lean Six Sigma projects and possess knowledge of Lean Six Sigma tools. Participants must also be able to read, write and speak English.

Benefits to Participating in the Study:
The research contributes to the body of knowledge by contributing insights for businesses implementing Lean Six Sigma projects. There is no monetary compensation for participation but your commitment one hour can go a long way to helping businesses and academia.

Privacy for Participants
Publication of the results will occur after completion of the study. Code names established by the researcher will replace any personal identifiable information to ensure participant confidentiality. The data will be stored with an encrypted, secured password. If there is a breach in security of the data, the data will not be of value.

Please submit the selected response directly to Victoria Reed at Victoria.reed@waldenu.edu. Responses also indicate that the potential participant is providing permission to the researcher to forward future communications on the study. Feel free to ask any questions. Thank you!

Appendix B: Interview Protocol

Author: Reed, 2019

Purpose of the Study

The purpose of this qualitative single case study is to explore the successful strategies that LSS project leaders use to mitigate projects' costs within manufacturing.

Case Study Research Question

What successful strategies do LSS project leaders use to mitigate LSS projects' costs?

Interview Protocol Questions

1. What successful strategies did you use to mitigate projects' costs?
2. Based upon your experience, what were the key factors, processes, and tools that contributed to the successful implementation of strategies to mitigate LSS projects' costs?
3. What key obstacles did you face during the implementation of strategies to reduce LSS projects' costs?
4. How did you overcome these key obstacles during the implementation of strategies to reduce projects' costs?
5. What additional information can you share with me about the successful implementation of strategies you and your organization used to reduce LSS projects' costs?

Your support and participation in this research study is appreciated.

Appendix C: Focus Group Protocol

Author: Reed, 2017

Purpose of the Study

The purpose of this qualitative single case study is to explore the successful strategies that LSS project leaders use to mitigate projects' costs within manufacturing.

Case Study Research Questions.

What successful strategies do LSS project leaders use to mitigate LSS projects' costs?

Focus Group Protocol Questions

1) What successful strategies did you use to mitigate projects' costs?
2) Based upon your experience, what were the key factors, processes, and tools that contributed to the successful implementation of strategies to mitigate LSS projects' costs?
3) What key obstacles did you face during the implementation of strategies to reduce LSS projects' costs?
4) How did you overcome these key obstacles during the implementation of strategies to reduce projects' costs?
5) What additional information can you share with me about the successful implementation of strategies you and your organization used to reduce LSS projects' costs?

Your support and participation in this research study is appreciated.

Appendix D: Participant Questionnaire Protocol

Lean Six Sigma Study Questionnaire **Researcher: Victoria Reed**

Participant Code: Date: _ Location (City/State): _____
Return Completed Questionnaire to: victoria.reed@waldenu.edu

Greetings and thank you for taking the time out of your busy schedule to participate in this research study. The purpose of this study is to explore how leaders of Lean Six Sigma projects describe selection of Lean Six Sigma tools that lead to outcomes resulting in cost savings for a competitive advantage. The questionnaire may take approximately one hour to complete.
Instructions: You are asked to contribute to this study by sharing your background and experience in response to the following seven questions. Please be specific in your answers. Please do not paste pictures or objects into your responses.

Research Question:
What successful strategies do LSS project leaders use to mitigate LSS projects' costs?

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1) What successful strategies did you use to mitigate projects' costs?
2) Based upon your experience, what were the key factors, processes, and tools that contributed to the successful implementation of strategies to mitigate LSS projects' costs?
3) What key obstacles did you face during the implementation of strategies to reduce LSS projects' costs?
4) How did you overcome these key obstacles during the implementation of strategies to reduce projects' costs?
5) What additional information can you share with me about the successful implementation of strategies you and your organization used to reduce LSS projects' costs?