4-15-2024

Strategies to Enhance the Success of Six Sigma Process Improvement Projects in Nonmanufacturing Environments

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This is to certify that the doctoral study by

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has been found to be complete and satisfactory in all respects,
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Walden University
2024

Abstract

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MBA, Walden University, 2014

BA, Lincoln Christian University, 2001

Doctoral Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Business Administration

Walden University

April 2024

Abstract

Six Sigma is a fact-based and data-driven methodology for improving products, processes, and services in companies across the world. Many project managers from various industries have tried to implement Six Sigma and have failed, resulting in poor quality of their products, inefficient processes, and cost increases. Grounded in the total quality management framework, the purpose of this qualitative single-case study was to explore strategies that project managers used to implement successful Six Sigma process improvement projects in nonmanufacturing environments. The participants were eight Six Sigma project managers who had experience in enhancing the success rates of Six Sigma process improvement projects at a community college in the Midwest region of the United States. The participants engaged in semi-structured interviews, and the constant comparison analysis was used to code responses and identify themes that emerged from the data. Three major themes emerged from the data analysis: (1) select projects based on opportunities for improvement, (2) leverage the Six Sigma toolbox, and (3) elicit leadership and stakeholder buy-in. A key recommendation is for business leaders and project managers to identify processes with waste that needs to be eliminated, long lead, cycle, and wait times that need to be reduced, and issues keeping staff from operating more efficiently and effectively. The implications for positive social change include the potential for project managers to enhance products, processes, and services and realize cost savings. From the cost savings, company leaders can allocate a percentage of their profits to nonprofit organizations to help underprivileged people through education, employment, housing, and financial programs.

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Dedication

I dedicate this doctoral study to my beautiful children, Lauren and Daniel. You are my greatest gifts in the universe, and I am honored to be your dad. Since you were born, you have motivated me to achieve our family's and my goals like no one else, and you continue to motivate me to this day. You are also highly intelligent and intellectual, goal-driven, creative, passionate, philanthropic, caring, and loving children, and I am so thankful for you! You will take The Whisker Family to even higher levels as we continue to build The Whisker Family Dynasty for generations. I love you so much!

Table of Contents

i

List of Tables

Section 1: Foundation of the Study

In Section 1, I will present the foundation of the study, which includes the

background of the problem; problem and purpose; nature of the study; research question;

interview questions; conceptual framework: operational definitions; assumptions,

limitations, and delimitations; significance of the study; and a review of the professional

and academic literature.

Background of the Problem

Managing priorities, time constraints, and tools is challenging for many Six

Sigma project managers. As Laux et al. (2015) noted, factors that contribute to the lack of

timely completion of Six Sigma projects include poor project selection, lack of project

management training, and lack of leadership. Despite being highly motivated to

successfully complete projects, some project managers eventually struggle to overcome

various project barriers. Some project managers do not plan their projects well and are

unable to balance their Six Sigma responsibilities and regular work duties. Project

managers also face barriers when senior managers do not visibly lead and support their

Six Sigma efforts.

Antony (2015) revealed that Six Sigma project managers have difficulty

implementing continuous improvement approaches in nonmanufacturing environments as

well. For example, project managers encounter numerous obstacles when they apply lean

Six Sigma to finance, human resources, administrative, and library processes in higher

education. In this doctoral study, I explored strategies for Six Sigma project managers,

who use the define, measure, analyze, improve, and control (DMAIC) roadmap, to

overcome these challenges and enhance the success of Six Sigma process improvement projects in nonmanufacturing environments.

Problem and Purpose

Six Sigma process improvement projects face multiple barriers that lead to unsuccessful applications (Ali et al., 2020). Antony et al. (2022) surveyed 307 Six Sigma experts around the world to explore their views on the Six Sigma methodology. The participants, who were from Africa, Asia, Europe, North America, and South America, were at different Six Sigma belt levels and levels of experience. Antony et al. found that poor implementation of Six Sigma had a negative impact on employee satisfaction, and this limitation was one of the top responses that represented 80% of the continents where the participants lived. The general business problem was that Six Sigma process improvement projects fail in some nonmanufacturing environments because of time constraints, competing priorities, lack of training, and lack of leadership buy-in and support. The specific business problem was that some project managers lack the strategies to implement successful Six Sigma process improvement projects in nonmanufacturing environments.

The purpose of this qualitative single-case study was to explore the strategies that project managers used to implement successful Six Sigma process improvement projects in nonmanufacturing environments. The target sample for the study consisted of eight project managers who worked at a community college in the Midwest region of the United States with successful experience implementing Six Sigma process improvement projects in nonmanufacturing environments. The cost savings that may result from

helping process improvement project managers enhance their companies have implications for positive social change. Company leaders can potentially allocate a percentage of their profits to nonprofit organizations to help underprivileged people through education, employment, housing, and financial programs and benefit their communities.

Nature of the Study

I chose the qualitative research method for this doctoral study. Qualitative researchers explore participants' practical experiences and behaviors related to the study phenomenon (Alam, 2021). Through the qualitative research method, I sought to capture the essence of the business problem and explore the strategies that project managers used to implement successful Six Sigma process improvement projects in nonmanufacturing environments. To do so, I focused on identifying the emerging themes from interviews with practitioners, using the inductive mode, and reflecting on the data.

I opted against using a mixed-methods approach. Mixed-methods researchers combine elements of quantitative and qualitative research approaches to address the specific business problem (Schoonenboom & Johnson, 2017). The quantitative research method was not appropriate for the study because I did not examine the relationships between variables. The mixed-method research approach was not suitable because there was no need to combine elements of quantitative and qualitative research approaches to address the specific business problem.

I used the qualitative case study research design to develop better insights into the research question (Annansingh & Howell, 2016). Phenomenological researchers focus

primarily on the reflections of people who have undergone shared human experiences, whereas ethnographic researchers focus on identifying and exploring groups' cultures, and narrative researchers seek to capture detailed stories from individuals about their life experiences (Yates & Leggett, 2016). I used a single-case study research design to develop better insights into the research question. The phenomenological design was not suitable for the study because my primary focus was not on the reflections of people with shared experiences. The ethnographical design was not appropriate because I did not focus on identifying and exploring groups' cultures. The narrative design was not appropriate because I did not capture the detailed stories and life experiences of a small number of individuals.

Research Question

What are the strategies project managers use to implement successful Six Sigma process improvement projects in nonmanufacturing environments?

Interview Questions

1. What strategies do you use to select the right nonmanufacturing Six Sigma projects?
2. What strategies do you use to select the appropriate project team members?
3. What strategies do you use to train project team members and key stakeholders before beginning Six Sigma projects?
4. What strategies do you use to overcome Six Sigma roadblocks like resistance from employees, lack of leadership buy-in, and others?
5. What strategies do you use to improve nonmanufacturing business processes and services through Six Sigma projects?

6. What strategies do you use to enhance the success rates of Six Sigma projects?

7. What strategies do you use to sustain nonmanufacturing Six Sigma projects'
    implementation?

8. How do you assess the success of your strategies for improving the success rates of
    Six Sigma projects?

9. What other information are you willing to share that I did not ask you regarding the
    strategies to improve nonmanufacturing environments?

Conceptual Framework

I used the total quality management (TQM) theory as the conceptual framework
for this doctoral study. In the 1950s, W. Edwards Deming introduced the theory (Ngambi
& Nkemkiafu, 2015). Quality improvement practitioners exported the TQM theory to
Japan, and the successful application improved the quality of products manufactured in
the country, which made Japan a dominant force in worldwide exports. Japan's success
helped spread the quality movement across the world. When U.S. corporate executives
began to adopt quality techniques to restore their competitiveness, Deming's theory
became more recognized in the United States.

According to Ngambi and Nkemkiafu (2015), Joseph Juran also contributed to the
TQM theory by providing the quality trilogy, which consists of operational quality
planning, quality improvement, and quality control. Juran asserted that to have successful
quality improvement projects, all actions for quality improvement should be thoroughly
planned and controlled. TQM involves preventing defects and errors in business
products, processes, and services, and it implies that every person from the senior-level

manager to the lowest staff becomes involved. TQM was applicable to this doctoral study because Six Sigma is a process improvement methodology that has a foundation of TQM.

Operational Definitions

Define, measure, analyze, improve, and control (DMAIC): A Six Sigma model consisting of five interconnected phases that company leaders use to solve problems and improve existing processes (Jirasukprasert et al., 2014; Sievers et al., 2014).

Nonmanufacturing: Business sectors and activities that do not make tangible products; examples include financial, trade, services, promotion, selling, distribution, logistics, and retail (Çiçekli & Kabasakal, 2016; Jeje, 2015; Ndaita et al., 2015).

Six Sigma: A business methodology used to improve company profitability and enhance the efficiency and effectiveness of all operations to meet or exceed customer expectations and needs (Uluskan, 2016).

Assumptions, Limitations, and Delimitations

Assumptions

Assumptions are value statements that researchers take for granted (Hibbert et al., 2014). My doctoral study has three assumptions. The first assumption was that the participating project managers used the Six Sigma methodology throughout the target college. The second assumption was that the college would have an adequate amount of Six Sigma project managers to interview. The third assumption was that I would be able to identify strategies to enhance the success of Six Sigma process improvement projects in nonmanufacturing environments based on the data I collected from the interviews. The

fourth assumption was that participants would respond openly and honestly to the interview questions.

Limitations

Limitations are the weaknesses that researchers face (Schary & Cardinal, 2016). I identified three limitations that could have restricted my ability to complete the doctoral study. The first limitation was that I could influence the study because of my experience as a Six Sigma black belt. The second limitation was that the sample size could be too small. The third limitation was the potential difficulty in generalizing the results because the sample represented a certain population, which might not be representative of all or different populations.

Delimitations

Delimitations are the boundaries of a doctoral study (Bilbo et al., 2015). I delimited the study to a community college located in the Midwest region of the United States. In addition, I delimited the study to Six Sigma project managers with successful experience implementing Six Sigma process improvement projects in nonmanufacturing environments. The scope of the study was limited to nonmanufacturing environments, excluding manufacturing environments, and there were time constraints to interview the participants and collect enough data.

<div align="center">

Significance of the Study

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Contribution to Business Practice

The study's findings could be of value to business managers who are planning to implement or have implemented the Six Sigma DMAIC process improvement

methodology in nonmanufacturing environments. Six Sigma can be challenging to apply for some companies (Antony, 2015). The study's findings may enable business leaders to learn how to successfully implement the methodology. Continuous improvement project managers who work in nonmanufacturing environments could learn strategies to effectively implement Six Sigma (DMAIC) process improvement projects.

Implications for Social Change

I expect that the study's findings can potentially help project managers enhance their companies through Six Sigma and reduce the costs of poor quality by improving business processes and services. From the cost savings, company leaders can potentially allocate a percentage of their profits to nonprofit organizations to help underprivileged people through education, employment, housing, and financial programs. Enhancing the lives of underprivileged people through these programs can potentially improve communities as well.

<center>**A Review of the Professional and Academic Literature**</center>

The research presented in this literature review was the foundation for my exploration of successful Six Sigma process improvement projects in nonmanufacturing environments. The review begins with a critical analysis and synthesis of the literature pertaining to the TQM conceptual framework with supporting and contrasting theories and conceptual models. The next subsection entails a critical analysis and synthesis of the literature pertaining to key topics, which are the TQM conceptual framework, Six Sigma roles and project selection, critical success factors for Six Sigma projects, the use of lean Six Sigma as a hybrid approach, and the implementation of Six Sigma.

I used government websites and peer-reviewed articles from academic journals to conduct the research. The primary research library was the Walden University Library. Primary databases and search engines used in the review were ProQuest Central, Business Source Complete, Emerald Insight, and Google Scholar. I searched for articles published from 2005 to 2023. The key search terms were *lean Six Sigma*, *Six Sigma and challenges*, *Six Sigma and implementation*, *Six Sigma and nonmanufacturing*, *Six Sigma and finance companies*, *Six Sigma and service companies*, *Six Sigma and nonprofit*, *Six Sigma and government*, and *Six Sigma and human resources*.

Application to the Applied Business Problem

The purpose of the qualitative study was to explore strategies that project managers used to implement successful Six Sigma process improvement projects in nonmanufacturing environments. The sample for the study was eight project managers at a community college in the Midwest region of the United States with successful experience implementing Six Sigma process improvement projects in nonmanufacturing environments. The implications for positive social change of the study include helping process improvement project managers enhance their companies. From the cost savings, company leaders can potentially allocate a percentage of their profits to nonprofit organizations to help underprivileged people through education, employment, housing, and financial programs and benefit their communities.

Strategies to Enhance the Success of Six Sigma Process Improvement Projects in Nonmanufacturing Environments

Patyal and Maddulety (2015) found that Six Sigma project managers have implemented the Six Sigma methodology in numerous companies from different industries around the globe. They systematically reviewed 36 TQM articles and 31 Six Sigma articles. They found that TQM and Six Sigma were two distinct concepts that shared similarities, but Six Sigma emerged as superior to TQM in some aspects. Using a qualitative research design and interview method, Adebanjo et al. (2016) discovered that continuous improvement practitioners use Six Sigma to improve business processes with the ultimate goal of increasing revenue, reducing costs, and generating profits. In three other supportive case studies, Gutierrez-Gutierrez et al. (2016), Isa and Usmen (2015), and Lameijer et al. (2016) found evidence that even though Six Sigma began in manufacturing environments, project managers employed it to improve nonmanufacturing processes as well.

Total Quality Management Conceptual Framework

The TQM framework is an American invention, but Japanese quality practitioners popularized the methodology (Bernardino et al., 2016). Although there is no consensus regarding the date of origin, there is agreement that the founders or quality experts of TQM are Philip Crosby, W. Edwards Deming, Armand Feigenbaum, Kaoru Ishikawa, and Joseph Juran (Bernardino et al., 2016; Ngambi & Nkemkiafu, 2015). TQM is an evolutionary methodology and took the place of total quality control, which Feigenbaum originated in 1960 (Ngambi & Nkemkiafu, 2015).

Quality practitioners successfully applied TQM in Japan, and the country had significant improvements in the quality of products, which allowed it to dominate exports worldwide (Ngambi & Nkemkiafu, 2015). Practitioners of the Japanese quality revolution modernized the American quality approach by promoting extensive training at all levels of a company and applying methods to examine business processes and continuously improve the quality of products and services (Bernardino et al., 2016). Business leaders were drawn to TQM because its use allowed Japanese practitioners to significantly improve their companies, products, and services. Because of the success of the quality movement in Japan, practitioners in the United States adopted quality and productivity methodologies to become more competitive in the 1970s and 1980s (Ngambi & Nkemkiafu, 2015).

Ngambi and Nkemkiafu (2015) revealed, however, that not all elements of TQM contributed to the enhancement of organizational performance in companies in the Republic of Cameroon. The TQM practices that played major roles in enhancing performance were employee training and empowerment, quality control and inspection, leadership commitment, and benchmarking. Customer service did not contribute to higher organizational performance. Overall, practitioners significantly improved companies in the country. Instead of focusing on how TQM experts enhanced company performance, Bernardino et al. (2016) discovered the TQM aspects that endured in Brazilian companies over 20 years. They conducted case studies of four Brazilian companies whose leaders adopted TQM. They discovered that TQM's predominant position as a management

philosophy remained part of the organizational environment of Brazilian companies over the study time frame.

Contrary to Ngambi and Nkemkiafu (2015), Barouch and Kleinhans (2015) found valid criticisms of and opposition to TQM. By conducting an exhaustive literature review, Barouch and Kleinhans identified several criticisms of quality management (QM), which were ignorance of QM, confusion of QM theory and definitions, and misuse of QM by senior management. Barouch and Kleinhans also found criticisms of the implementation and results of QM, and one criticism was that QM researchers did not demonstrate the probability of QM in the literature. Findings from a survey distributed to 4,000 British companies that had the QM framework showed that the program operated with a reasonable degree of success but did not have a demonstrable impact on the financial performance of some companies (Wilkinson et al., 1994, as cited in Barouch & Kleinhans, 2015). Another criticism in several case studies that they reviewed was that TQM led to failure. Barouch and Kleinhans also found in the literature that the failure rate estimates of TQM varied from approximately two thirds as high as 90%. The programs that survived reported high levels of dissatisfaction.

To identify new avenues of research on the changes in management and quality especially regarding customers, Aquilani et al. (2017) conducted a systematic review of the literature using three databases, which were EBSCO, JSTOR, and SpringerLink, and the search engine Google Scholar. They discovered three different clusters of papers: identification papers, which highlighted that customer focus has gained significance recently; implementation papers, which illuminated that a shared model or general model

to successfully implement TQM did not exist yet; and impact-on-performance papers, which showed that a minimal number of researchers did not address the relationship between the issues of business performance and TQM. The impact-on-performance papers underscored the largest gap in the TQM literature.

Aquilani et al. (2017) also uncovered the 10 most important critical success factors in the literature. Aquilani et al. recommended that practitioners implement the most important critical success factors in their companies. Mehralian et al. (2016) had a similar research focus. They identified and prioritized the critical success factors of TQM within the pharmaceutical industry but had a different research approach compared to Aquilani et al. Mehralian et al. developed a questionnaire and sent it to 320 managers in the pharmaceutical industry. Analysis of the 210 questionnaires that were returned showed that information and analysis, management commitment, supplier relationships, and customer focus were the top four critical success factors of TQM implementation.

Aquilani et al. (2017) did not find many studies about the correlation between performance and TQM. However, Psomas and Jaca (2016) explored the impact of TQM factors on the performance dimensions of service companies in Spain. Psomas and Jaca designed a research project focused on the Spanish services sector in which they randomly selected companies for analysis whose leaders had implemented TQM; 151 company representatives responded and completed a questionnaire. Through multiple linear regression analysis, Psomas and Jaca discovered TQM factors that affected the performance of companies. Like Psomas and Jaca, Bouranta et al. (2017) also applied multiple linear regression analysis to examine how TQM practitioners used TQM

elements to improve company performance, but Bouranta et al. focused their research on the hotel industry in Greece. Bouranta et al. found the key practices for quality in the Greek hotel industry to be employee education, employee QM, customer focus, strategic quality planning, and top management.

Psomas and Jaca (2016) revealed in their findings that the impact of TQM implementation in service companies was employee QM, employee education and knowledge, process management, employee QM, and customer focus. Psomas and Jaca uncovered the performance factors as well, which were product and service quality performance, operational performance, and financial performance. Psomas and Jaca underscored that the TQM factors regarding top management, employees, and customers were the factors that impacted the performance of companies significantly. Bouranta et al. (2017) also highlighted some of the same TQM elements to improve hotel performance by fielding an empirical survey of 153 top-and-middle-level hotel-quality managers in Greece. Bouranta et al. used exploratory factor analyses and multiple linear regression analyses to deduce the TQM elements that impacted hotel performance, which were top management, strategic quality planning, employee QM, customer focus, and employee knowledge and education.

Similar to Aquilani et al. (2017), Bajaj et al. (2018) conducted a literature review to analyze TQM practices and their impact on the performance of a company. Because TQM has gained significance among businesspeople, practitioners, managers, and research scholars over the past 20 plus years, they viewed it as pertinent to critically assess the TQM literature to discover where future research would be required. They

scrutinized TQM practices and TQM's impact on business performance, and they

suggested a generalized TQM framework that could be applicable regardless of the

sector. Bajaj et al. recommended 17 TQM practices from the results of their Pareto

analysis. The TQM practices are customer focus and satisfaction, process

management/efficiency, education and training, employee involvement and

empowerment, top management commitment, information and analysis, leadership,

continuous improvement, human resource management and development, supplier

relationship/management, strategic planning, quality assurance/role of the quality

department, communication, benchmarking, quality system, teamwork, and product and

service design. They researched the TQM practices that affected company performance.

Prajogo and Cooper (2017) had a slightly difference research focus and examined

the TQM practices that affected job satisfaction among 201 employees who worked in 23

companies in Australia. They used multilevel modeling to test their hypotheses. They

found that the people-related TQM practices of empowerment, training, involvement, and

teamwork were positively related to job satisfaction.

Habbal and Jreisat (2018) studied barriers to the successful implementation of

TQM in United Arab Emirates higher education institutions. Due to the elevating

awareness and demand of TQM, leaders of colleges and universities have been expected

to apply international quality standards to overcome competitive obstacles and maximize

customer loyalty. To identify the elements that limited TQM application in higher

education institutions and to test their three hypotheses, They collected survey data from

four United Arab Emirates universities. They found that TQM implications were driven

primarily by the faculty's lack of understanding and importance of quality standardizations, and they revealed that faculty focused on rigid and repetitive educational tools instead of focusing on innovative learning practices. They suggested that promoting quality culture, supporting continual learning, and quality incentives played key roles in averting TQM failures.

Habbal and Jreisat (2018) found that the major challenges that prevented successful TQM applications in higher education institutions were a weak understanding of the concept of continual learning or continuing education, weak financial support for scientific research, weak library capabilities, expanded teaching load at the expense of scientific research, lack of participation of faculty with local and international research centers, poor communication between departments, and lack of confidence in faculty members. According to Bruçaj (2018), TQM, in colleges and universities, is an all-inclusive managerial approach. Bruçaj contended that leaders in higher education should focus on continuous improvement of quality; include all university staff, students, and stakeholders; and maximize the performance of the university. Additionally, to have an effective and successful implementation, university personnel should adopt a TQM framework, and university officials should have direct engagement with the major responsibility of employing the quality standards.

Ajayi and Oyeniyi (2017) explored low academic performance, though their focus was on secondary schools rather than higher education. They investigated the impact of TQM on students' performance. They researched whether TQM correlated with the academic performance of 478 public secondary schools in Ogun State. They revealed that

the application of TQM vis-à-vis the employment of quality teachers, provision of physical resources, and setting of achievable goals and objectives contributed significantly to the academic performance of students. Although the quality of personnel (teachers and principals) and physical facilities, and the principles of TQM positively affected the academic performance of students, they were not the only factors. Supervision of instruction, student self-efficacy, study habits, students' socioeconomic factors, peer influence, environmental factors, and administrative styles also had an influence on school outputs. Based on their findings, They recommended the adoption and application of TQM at schools to enhance the academic performance of students.

Likewise, through a literature review, Hasham (2018) underscored how TQM could positively affect the education of universities. Higher education institutions can achieve educational reform through synergy, continuous improvement, and a system with ongoing support from leadership and top management at universities. Everyone in a higher education institution must be aligned with TQM principles by redefining roles, clearly communicating responsibilities, planning leadership training at every level, and developing staff to address beliefs and attitudes. TQM practitioners in higher education institutions must stress the importance of training as a tool to improve operational performance and employee performance, and to reach customer satisfaction, Hasham asserted.

Oschman (2017) conducted a unique study of the direct correlation between strategic planning and the successful implementation of TQM. Oschman used a questionnaire to gather data on strategic planning from personnel of different

management levels at eight South African Air Force bases. Oschman found that strategic

planning was an influential dimension in successfully implementing TQM. To determine

the correlation between strategic planning and successful implementation of TQM,

Oschman used a computer-assisted reliability analysis to test the data. Oschman's results

validated that strategic planning played a crucial part in implementing the TQM

framework. The research by Oschman contributed to the existing literature by offering a

complete and more integrated view of how strategic planning supports the

implementation of TQM in order to enhance the business activities of companies.

Oschman recommended the incorporation of strategic planning into the TQM framework

for companies to perform better, beat the competition, and create a competitive

advantage.

Total Quality Management Versus Lean

Sunder (2015) identified lean and Six Sigma as the two most popular and

powerful strategies for process improvements. Sunder explored the perspectives of lean

and Six Sigma practitioners from various corporations. The researcher found 17

differences and 14 commonalities between Six Sigma and lean, and he categorized the

findings under four categories, which were approach, customer, focus, and organization.

Sunder also found that lean stood out as a key approach to making business processes run

more efficiently.

Shokri (2017) used a different research approach than Sunder (2015). Shokri

conducted an analysis of lean, Six Sigma, and lean Six Sigma (LSS) over a 20 year span

and identified the research gaps. The researcher collected secondary data and conducted a

literature review to amass information about peer-reviewed journal articles under six dimensions of a tested classification framework. Shokri discovered multiple research outputs about lean, Six Sigma, and LSS, but the articles were primarily limited to a few industries like general manufacturing, healthcare, automotive, and electronic. The themes of the articles were tools and techniques, benefits, and success factors. Shokri also found that there was a great disparity among the researchers to publish literature about the three business process improvement practices. Shokri concluded that the average number of LSS publications had increased since 2008, but the number of articles about Six Sigma had decreased.

Lean management is a business process improvement strategy and a systematic removal of waste by everyone in the company from all areas of the value stream. Shokri (2017) found lean to be one of the few practices that people consider a philosophy and a tool. According to Shokri, lean management practitioners generate value through understanding and fulfilling customer requirements, mapping the process, promoting the flow of value from and to stakeholders, and pulling value from customers in order to move toward perfection. There are multiple benefits of using lean like reducing work-in-process, reducing cycle time, reducing inventory, increasing competitive advantage, and enhancing product and business performance.

Like Shokri (2017), Gupta et al. (2016) studied the importance of the lean approach through an exhaustive literature review. They highlighted the implications and application of lean in the service industry from its inauguration in the 1990s to the modern era. They summarized the evolution of lean in services and systematically

classified the literature review into four dimensions, which were time, publisher, region, and content. They found that lean was gaining momentum but was at the nascent stage based on the literature. Through the study, they illuminated the applicability of lean manufacturing principles to services that have limitations because of the service industry's characteristics. To implement lean effectively, they emphasized the importance of focusing on the process differences between services and manufacturing, respecting people, employee engagement, standardizing lean principles and tools, and creating guidelines for structured implementation in the service industry.

According to Gupta et al. (2016), practitioners applied lean in banking to save time, have a positive effect on the budget, and create more efficient processes. Lean helped university education and research projects reduce the delivery time in knowledge and packaging course size as per need. In USA hospitals, lean improved on-time starts, decreased operating room turnaround time, and decreased the number of cases rescheduled and same-day surgery cancellations.

Al Mouzani and Bouami (2016) found through a literature review of the TQM framework and lean approach that they have similarities and unique differences. Through a comparison and evaluation of the literature, They found that TQM and lean have similarities concerning origin, methodologies, effects, and tools. The two methodologies are different in theory and approach though. They uncovered that managers focused on customer needs and increasing customer satisfaction through both approaches. Continuous improvement is a key target for both approaches as well. Managers from various companies in different industries use the two approaches concurrently to improve

business processes because they complement each other. They discovered that when

continuous improvement practitioners combine the two methodologies, they could reap

benefits since lean has excellent roadmaps that practitioners could apply it with the

values of TQM.

Total Quality Management Versus Six Sigma

Patyal and Maddulety (2015) explored the various dimensions of the TQM and

Six Sigma methodologies through an extensive literature review. They revealed that even

though TQM and Six Sigma have similarities, they also have significant differences.

They concluded that Six Sigma is much superior to TQM in some aspects, but

practitioners should integrate the two approaches to create a synergistic effect on process

improvement performance, which could increase overall company performance.

There are obstacles that project managers must consider when implementing

TQM and Six Sigma. After conducting primary research through a case study on the

largest European construction machinery producer, J.C. Bamford Excavators, Ltd., Sabet

et al. (2016) found that a major pitfall of TQM was the inability of project managers to

eliminate the root causes of defects and problems in products, processes, and services

when they have applied TQM. One of the main obstacles to successful TQM and Six

Sigma applications is the lack of training (Majstorovic & Sibalija, 2015). Patyal and

Maddulety, Sabet et al. , and Majstorovic and Sibalija concluded that to bridge the gap

between theory and practice, it is imperative that companies have proper training

programs.

Six Sigma Roles and Project Selection

Antony and Karamina (2016) distributed surveys to Six Sigma black belts across the globe about their skills, roles, and responsibilities. They received 105 responses from the black belts who worked in companies from 14 countries. The findings from the survey showed that the most important roles and skills of a black belt were being a change agent and advocate of the statistical analysis tools, using analytical skills and expertise of the DMAIC-related tools and techniques, and the inclusion of soft skills in the black belt curricula.

Marzagão and Carvalho (2016) provided a different research approach vis-à-vis the critical success factors and roles of Six Sigma compared to Antony and Karaminas (2016). Marzagão and Carvalho used a quantitative methodological approach in two phases. They found in the literature review that the critical success factors of clear roles in the Six Sigma structure, full-time dedicated black belts, and clearly allocated green belts were pertinent for optimal project performance. Through the survey-based research, they discovered that not all of the claimed critical success factors from the literature review were imperative for project performance.

Yousefi and Hadi-Vencheh (2016) accentuated that selecting the proper Six Sigma project takes precise analyses. Six sigma projects should be initiated to meet the strategic goals of a company. Based on a literature review conducted by the researchers, Six Sigma projects should be selected to save costs, eliminate defects per million opportunities in a process, meet customer needs, and optimize internal performance.

Adebanjo et al. (2016) investigated the criteria for Six Sigma project selection from different studies. They found that customer, financial, and operational impacts were the most significant factors in selecting Six Sigma projects. They discovered that Six Sigma project managers should select projects based on the technical feasibility and availability of appropriate resources, cost reduction, revenue generation, and customer satisfaction. In the study, they emphasized that project managers should also select projects based on the reduction in cycle time, improved compliance and controls, attracting, retaining, and improving skills and knowledge, mutual benefits, and enhanced capability.

Padhy (2017) performed a literature review that focused on the Six Sigma selection process. Through the literature review, Padhy proposed a Six Sigma selection framework with three phases. The first phase of the framework was project identification by generating ideas from management, technicians, or operators. The second phase was project selection depending on the company's needs through various selection tools like critical to quality tree, value stream mapping, voice of the customer, and surveys. The third phase was project execution.

Critical Success Factors for Six Sigma Projects

Laux et al. (2015) researched that to enhance the success of Six Sigma projects, leaders should be committed and participate, projects should align with the voice of the customer and business strategy, there should be a consistent Six Sigma framework, project managers should be trained in project management and use project management skills, use the Six Sigma tools, and have a method in place to select the best projects. Huq

(2017) studied two companies where Six Sigma project managers implemented the methodology successfully and where Six Sigma was a failed attempt. Huq used these two companies to propose and validate a new competency model. Project teams from the successful company had leaders who were not stagnant but empowered their employees and Six Sigma project teams. The project teams at the unsuccessful company had middle managers who led their Six Sigma initiatives and did not have a CEO who was engaged. Huq found that top management support and employee participation were interdependent and essential for successful Six Sigma implementations.

Through 21 one-on-one telephone interviews with lean Six Sigma practitioners, Laureani and Antony (2015) discovered 10 predominant leadership characteristics that needed to be prevalent in Six Sigma deployments. The characteristics were visible, communicative, inspirational, consistent, targeted, leading by example, flexible, perceiving lean Six Sigma as a philosophy, clearly defining roles and responsibilities, and being able to build. Based on a Six Sigma literature review, Tlapa et al. (2016) also presented three critical success factors that project managers can apply to improve project performance, which were top management support, implementation strategy, and collaborative teams.

Future Research on Critical Success Factors

In the literature, authors highlighted critical success factors for implementing Six Sigma in manufacturing, construction, Brazilian, Indian, Greek, service, and small and medium companies. The authors used various research approaches. Lande et al. (2016), Tlapa et al. (2016), and Siddiqui et al. (2016) performed literature reviews to discover

critical success factors. Laux et al. (2015) conducted a descriptive study, and Tsironis and Psychogios (2016) interviewed numerous managers. Ribeiro de Jesus et al. (2016) and Psomas (2016) distributed surveys and questionnaires and used factor analysis.

There were limitations and needs for future research in the literature. Tsironis and Psychogios (2016) conducted research on three companies in the service industry regarding the critical success factors of lean Six Sigma, but a limitation was that the authors primarily interviewed top administrators and managers. Psomas (2016) also had a limitation of not having a larger sample size that included frontline employees. Future researchers could conduct studies with frontline employees who are involved directly in Six Sigma and could have a clearer view of the impact of critical success factors on Six Sigma implementation (Tsironis & Psychogios, 2016).

Lean Six Sigma as a Hybrid Approach

Abu Bakar et al. (2015) revealed that continuous improvement practitioners had used the hybrid application of lean and Six Sigma in numerous companies across various industries. They found that the concepts of lean and Six Sigma were exceedingly popular with large companies because of their positive influence and results on productivity, quality, and financial results, and they strengthened the market position of companies. Project managers used lean to enhance the speed of business processes and Six Sigma to improve the accuracy of meeting customer requirements as well. When project managers use the joint application of lean and Six Sigma, they can improve the performance of the entire organization.

Lean Six Sigma in Nonmanufacturing Environments

LSS has its origins in manufacturing companies, but project managers have increasingly used the methodology in service and nonmanufacturing companies like financial services, logistics, and higher education (Gutierrez-Gutierrez et al., 2016; Isa & Usmen, 2015; Lameijer et al., 2016). Through a viewpoint paper that encompassed a review of the literature and examples of successful lean Six Sigma implementations in the UK public sector, Antony, Rodgers, et al. (2016) uncovered that additional work was needed to better evidence the advantages and return on investment of lean Six Sigma in this sector. They learned that there was not enough evidence of successfully embedding lean Six Sigma across a whole public sector agency, and practitioners should evaluate the barriers and challenges before considering this implementation in the public sector.

Based on a literature review of LSS and a case study of Taiwanese companies, Cheng (2017) presented how LSS can be employed to reduce stock costs by improving inventory performance. Cheng compared and contrasted the three inventory models, which were the basic fixed-order-quantity model, the Economic Order Quantity model, and the two-bin approach. In the study, the author also offered recommendations for practitioners to consider when implementing LSS. The first recommendation was to know what to do in implementing LSS. The second recommendation was to understand that employee involvement is the key critical success factor. The third recommendation was to pursue customer satisfaction and loyalty. The fourth recommendation was to use process orientation and know the root causes of the problems within the process. Knapp (2015) studied the correlation between organizational culture and LSS. The researcher

found that for a successful Six Sigma implementation in hospitals, leaders should foster

collaboration, employee involvement, clear communication about the LSS initiatives, and

help employees clearly understand and be committed to applying the LSS practices.

Future Research on Lean Six Sigma

In the literature, researchers have used various types of research approaches like

single-case studies, multiple-case studies, conceptual papers, literature reviews, surveys,

and viewpoints from corporate professionals to study the implementation of LSS (Antony

et al., 2016, Elias, 2016, Isa & Usmen, 2015, Lameijer et al., 2016, Peteros & Maleyeff,

2015, Sunder, 2015, Zhang et al., 2016). Gutierrez-Gutierrez et al. (2016) conducted a

case study of LSS in the logistics services of a large consumer electronics company in the

Netherlands, and Zhang et al. surveyed 410 companies registered under the Singapore

Logistics Association. Gutierrez-Gutierrez et al. had weaknesses because the sample size

was not large enough. Zhang et al. also did not have a high response rate because only 32

companies out of 410, in the Singapore Logistics Association, responded to their surveys.

Sunder and Lameijer et al. provided strong studies through viewpoints of corporate

professionals with experience in implementing LSS in different countries across the

globe and multiple case studies using a mixed-methods approach with qualitative and

quantitative analysis.

Future researchers should ensure larger sample sizes, when surveying companies,

to generate higher response rates (Zhang et al., 2016). Researchers could expand their

studies with broader geographical coverage to obtain more analysis about LSS as well.

Since the literature on LSS is limited, future research could also focus on the

implementation in specific contexts (Gutierrez-Gutierrez et al., 2016).

Implementation of Six Sigma

Birckhead (2015) discovered that there needs to be an organizational culture

change for lean, Six Sigma, or continuous improvement implementations to be

successful. Translating production methods from manufacturing environments to

nonmanufacturing environments and services can be complex (Kovacs, 2015). Because

of this implementation challenge, Kovacs and Uluskan (2016) recommended that project

managers should apply the tools from the DMAIC toolbox and be flexible in the

implementation process. Though the target failure rate for the Six Sigma project is 3.4

defects per million opportunities, achieving such performance may require project

managers to have a larger reduction in variation and greater process improvement efforts

(Aldowaisan et al., 2015). Laureani and Antony (2016) revealed through a literature

review on leadership, LSS, and critical success factors for continuous improvement

programs and a survey questionnaire that leadership was the most important factor for

effectively implementing LSS.

To explain the application of Six Sigma in education, LeMahieu et al. (2017)

presented a case study of a Six Sigma deployment in a school-community partnership in

Milwaukee, Wisconsin. In the study, LeMahieu et al. found the core principles for a

successful application in this nonmanufacturing environment. Practitioners should

decrease unreliability and variability in business processes, eliminate waste and non-

value-added process steps, identify defects, reduce costs in business processes, and

improve client satisfaction levels. Though practitioners have improved the financial performances of companies through Six Sigma, Ozkan et al. (2017) analyzed 108 Fortune 500 companies and found that the methodology comes at the expense of overloaded staff levels and billions of dollars committed to Six Sigma training.

Honda et al. (2018) studied how healthcare professionals can improve hospital performance through LSS principles. They conducted a qualitative analysis of 35 published case-based papers and discovered that LSS could significantly improve process performance in hospitals by reducing wait times and patient flow and increasing patient satisfaction. When practitioners in hospitals applied LSS in hospitals, they also reduced inventories and operating costs, which translated into significant savings.

Spasojevic Brkic and Tomic (2016) surveyed 500 companies in a multinational company supply chain to find if employees' factors were predictors and response variables in the LSS methodology. They discovered that training and a reward system were predictors of LSS activities. They also found that different approaches to LSS, like DMAIC, DMADV, and 5S, positively influenced employee performance in the areas of employee satisfaction, salaries and benefits, absenteeism, turnover rate, and commitment.

Uluskan (2016) conducted a comprehensive literature review of 60 articles to illuminate the most used Six Sigma tools, the classification of the tools, the flow of the tools concerning the DMAIC approach, tools as critical success factors, and reasons for the ineffective use of the tools. Uluskan found that when project teams decide to solve their problems through the DMAIC approach, they struggle with identifying when to use the most appropriate tools. Through this lens, the researcher offered recommendations for

Six Sigma project managers to apply the tools accurately and effectively. For Six Sigma practitioners to implement the Six Sigma methodology successfully, they must apply specific and pertinent tools and techniques. Six Sigma practitioners can use the DMAIC approach to systematically improve processes using various tools during each phase.

Barriers and Challenges Related to Implementing Six Sigma

Though Uluskan (2016) promoted the tools to implement Six Sigma successfully, Antony, Gijo, et al. (2016), underscored the barriers and challenges in addition to the benefits of implementing Six Sigma. They used the qualitative research design and conducted a multi-case study using the exploratory case study approach to obtain deeper insights into Six Sigma implementation in three manufacturing companies in India. They conducted interviews in all three companies with relevant Six Sigma staff, which consisted of Six Sigma deployment champions, Six Sigma master black belts, and Six Sigma black belts.

Company A was a solar cell manufacturer in the southern part of India. Antony, Gijo, et al. (2016), found that during the early days of the company's adoption of Six Sigma, there was strong resistance from the shop floor workers and supervisors. Some employees did not have a clear understanding of the benefits of Six Sigma and how practitioners apply the methodology as a catalyst for change. To rectify these problems, senior managers provided awareness programs for people on the shop floor and the executives, so they could understand the expectations and benefits of the Six Sigma initiative.

Company B was a large electrical manufacturer in the northern part of India and was one of the leading public sector companies. Antony, Gijo, et al. (2016), discovered that this company extended the Six Sigma applications from solely manufacturing to support functions like finance, human resources, sales, purchasing, and maintenance. One of the major obstacles that the researchers revealed from the case study was this company struggled with retaining the Six Sigma black belts. After receiving Six Sigma training and executing projects, the black belts left the company for highly paid jobs in other competitive companies. This problem created massive issues in finding qualified candidates for executing Six Sigma projects across the enterprise. Despite the turnover in black belts, Company B was able to reap the benefits of Six Sigma through productivity improvements, reductions in rework from excessive commutator ovality of a traction motor, and the improvement of patient satisfaction by reducing patient wait times at the hospital that was attached to the company.

Company C was an industrial compressor manufacturing company. Antony, Gijo, et al. (2016), uncovered that the practitioners used lean and Six Sigma to improve the company's processes. The authors found that the company had a high attrition rate of talented people like Company B. Out of the 47 trained green belts, about 10 of them left the company before completing their projects. They also revealed that when senior management extended Six Sigma to nonmanufacturing environments, they experienced many challenges for multiple years. Senior managers and a large proportion of the employees had misconceptions that Six Sigma only applied to manufacturing environments and practitioners could not transfer the methodology to nonmanufacturing

processes like marketing, sales, finance, and so forth. Antony, Gijo, et al. discovered the benefits of Six Sigma in this company as well. Continuous improvement practitioners improved on-time delivery of a particular model of compressors, reduced raw material inventory, and decreased lead time for supplier bill processing.

Future Research on Six Sigma

In the literature, project managers have implemented Six Sigma in universities, public utilities, the banking sector, healthcare, for financial portfolio risk management, the military, human resources, construction, and for credit card account processes (Antony, 2015; Antony, Snee, & Hoerl, 2017; Arif, 2016; Bhat, Gijo, & Jnanesh, 2016; Ha et al., 2016; Hess & Benjamin, 2015; Islam, 2016; Madhani, 2017; Mefford et al., 2017; Ndaita et al., 2015; Noriega et al., 2016; Peteros & Maleyeff, 2015; Prashar, 2015; Svensson et al., 2015; Thomas et al., 2017). The authors used various research approaches like case studies, conceptual papers, viewpoints, observations, literature reviews, and surveys (Antony, 2015; Garza-Reyes, 2015; Sunder & Antony, 2015; Svensson et al. 2015; Thomas et al. 2017; Uluskan, 2016).

In the future, researchers should ensure that they increase their number of participants to receive adequate data about the implementation of Six Sigma (Antony, 2015). Since most of the researchers focused on manufacturing, future research could include transactional processes (Islam, 2016). The authors from the literature primarily researched existing processes using the DMAIC approach of Six Sigma, and a gap in the literature existed regarding the define, measure, analyze, design, and verify (DMADV) methodology.

Transition

      In Section 1, I presented the foundation of this doctoral study, which included the background of the problem; problem and purpose; nature of the study; research question; interview questions; conceptual framework; operational definitions; assumptions, limitations, and delimitations; significance of the study; and review of the professional and academic literature. In Section 2, I will present the purpose statement of my qualitative case study, a detailed explanation of the role of the researcher, the specifics of the participants, research method and design, population and sampling, and ethical research. Section 2 will also contain the data collection instrument, data collection technique, data organization techniques, data analysis, and reliability and validity. In Section 3, I will cover the presentation of the findings, application to professional practice, implications for social change, recommendations for action, recommendations for further research, my reflections, and the conclusion.

Section 2: The Project

Introduction

In Section 2, I will cover the following subsections: the purpose statement, the role of the researcher, participants, research method and design, population and sampling, ethical research, data collection instruments, data collection technique, data organization techniques, data analysis, and plans for assuring the study's reliability and validity.

Purpose Statement

The purpose of this qualitative study was to explore the strategies that project managers used to implement successful Six Sigma process improvement projects in nonmanufacturing environments. The sample for the study consisted of eight project managers at a community college in the Midwest region of the United States with experience in successfully implementing Six Sigma process improvement projects in nonmanufacturing environments. The study's implications for positive social change include helping process improvement project managers enhance their companies to realize cost savings. From the cost savings, company leaders can potentially allocate a percentage of their profits to nonprofit organizations to help underprivileged people through education, employment, housing, and financial programs and benefit their communities.

Role of the Researcher

My role in the study was multifaceted. Santha et al. (2015) highlighted that the researcher is responsible for designing a doctoral study; choosing the participants; and collecting, organizing, analyzing, and presenting the data from the study. I designed the

study; selected participants; collected, organized, and analyzed the data; and presented

the results. I have prior knowledge and experience pertaining to the research topic. I

received my Six Sigma black belt from Caterpillar in 2010 and my lean certifications

from State Farm Corporate Headquarters in 2015. I worked at a nonprofit organization as

a Six Sigma black belt and at a Fortune 50 company in Central Illinois as a process

analyst where I helped the companies improve various nonmanufacturing processes. My

other work experiences, all in the Chicago area, include roles as a senior business process

improvement analyst at a global forensic company, as a manager of continuous

improvement at a consulting company, and currently as senior manager of finance

process improvement at a railcar pooling company. In all these roles, I applied LSS to

enhance business processes in nonmanufacturing environments.

Conducting the study in an ethical manner was a key part of my research role. The

basic ethical principles outlined in the *Belmont Report* are respect for persons,

beneficence, and justice (U.S. Department of Health and Human Services, 1979). The

first principle is respect for persons. Miracle (2016) stated that research participants are

autonomous human beings who have the right to decide whether they want to engage in a

study. Children or those who are mentally challenged require the utmost protection as

well. The second principle is beneficence, which is simply the principle of doing well to

others. The third principle is justice, which demands fairness for and equal treatment of

all participants. As the researcher, I followed the ethical principles of the *Belmont Report*

and protected the rights of the human participants of the study. I respected participants by

acknowledging their autonomy, and I conducted research with beneficence by averting or

minimizing harm to the participants and maximizing the potential benefits for the

participants. I also considered justice when I conducted research by distributing benefits

to the participants equally and fairly.

Fusch and Ness (2015) stated that the researcher's role is a significant part of the

study. It is a challenge for novice researchers to avoid viewing data through a personal

lens because they assume they have no bias during the data collection process. To prevent

this mistake, I recognized the bias I had as a novice researcher. During the data collection

process, I refrained from injecting my knowledge and experiences into the research topic

as well. I allowed the data from the participants to be the foundation of my research.

According to Castillo-Montoya (2016), the purpose of an interview is to amass

information relative to a study. Dikko (2016) stated that an interview protocol is a set of

guidelines and rules that researchers use to conduct interviews. I aligned the interview

protocol with the purpose of my doctoral study and strived to answer the research

question through the data I collected. I also employed the interview protocol to support

an inquiry-based conversation with the participants.

Participants

According to Yssel et al. (2016), researchers use purposeful sampling to recruit

participants who can offer the most insights about a research topic. To elicit information-

rich insight about the study topic, I recruited participants who were Six Sigma project

managers and who had implemented successful Six Sigma projects in nonmanufacturing

environments at a community college in the Midwest region of the United States. They

also were able to provide strategies to enhance the success of Six Sigma process

improvement projects in nonmanufacturing environments.

To gain access to volunteers and recruit participants for the study, I followed

Yssel et al. (2016)'s recommendation of emailing information about my study to a

university director and requesting that the director forward the email to students. After I

received approval from the community college's Office of Institutional Planning and

Research, I asked the director of institutional planning and research about the permissible

methods of gaining access to the participants. I sent an email to the director explaining

the study, and I asked him to forward the email to process improvement practitioners at

the college. I also obtained referrals from other employees who were already in my

network.

According to Danso (2015), it is imperative for a researcher to recognize that

differences pervade human interactions, and the researcher should proactively align with

the participants' cultural norms to reduce the differences during the interview process.

The researcher should build trust with the participants and protect their identities

(Saunders et al., 2015). The researcher should also have a confident approach and use eye

contact when interviewing participants (Baškarada, 2014). To establish working

relationships with the participants, I tried to break down any cultural and personality

barriers between myself and the participants by respecting their opinions and experiences

and by keeping the communication open during the interviews. Though the

anonymization process can be challenging, I built trust with the participants and assured

them that I would protect their identities by labeling them "P1," "P2," and so forth and by

refraining from using the community college's name on the written transcripts. I built

rapport with the participants and helped them relax if they were nervous by ensuring that

there were no wrong answers because I would be amassing information from their

experiences. I used eye contact and had a confident manner when interviewing the

participants. I also encouraged the participants to speak freely and reaffirmed that I would

follow up with them and use member checking to verify my interpretations of the data.

Research Method and Design

Research Method

Makrakis and Kostoulos-Makrakis (2016) stated that researchers use the

qualitative research method for explorations, holism, flexibility, comprehension, and

meaning-making. The researcher applies this method to focus on meanings and evaluate

processes that are not controlled. I used the qualitative research method for this doctoral

study to explore the strategies to enhance the success of Six Sigma process improvement

projects in nonmanufacturing environments, focus on meanings, and evaluate processes.

Makrakis and Kostoulos-Makrakis (2016) and Santha et al. (2015) highlighted

that researchers use the quantitative research method to measure, test hypotheses, test

relationships between variables, or when they need numerical representation. Researchers

also employ the mixed-methods approach by merging the qualitative and quantitative

methods (Makrakis & Kostoulos-Makrakis, 2016). I did not use the quantitative research

method because I did not emphasize measurement, test hypotheses, or test relationships

between variables, and I did not need a numerical representation for this single-case

study. I also did not employ the mixed-methods research approach.

Research Design

Kruth (2015) stated that the single-case study can be an event, a series of events, or just an individual and differentiated from other cases. Through the single-case study, the researcher explores a bounded system or a single case from multiple participants and obtains various perspectives. The research design that I used for this doctoral study was the single-case study. I explored a bounded system or a single case from multiple participants within a single organization and obtained various perspectives. I gained a deeper understanding by collecting and analyzing data from interviews via Zoom meetings and one phone call.

Kruth (2015) also stated that through the phenomenological research design, the researcher focuses on understanding the participant's life experiences, and data collection consists of interviews with people who have had particular life experiences, focus groups, documents, writings, observations, and works of art. Researchers use the ethnographic research design to describe a shared experience from a particular group with a common culture (Draper, 2015; Kruth, 2015). Through the narrative research design, researchers only identify events and collect data from an individual's storytelling (Creswell & Creswell, 2017). I did not use the phenomenological, ethnographic, or narrative research designs for this doctoral study because the single-case study was the research design that helped me accomplish my data collection goals. I did not focus on understanding experiences, using cultural nuances, or conducting storytelling research.

According to Fusch and Ness (2015), researchers attain data saturation when there is enough information to replicate the study when they cannot obtain new information.

Birt et al. (2016) stated that member checking is a technique for validating the results from interview participants. Though the community college had a policy that I could not collect data through project meeting documents, nevertheless, I reached data saturation through the interviews.

Population and Sampling

According to Roy et al. (2015), qualitative researchers start by using a predetermined sample size. The sample size of participants should increase the chances of accurately representing the population, and researchers should conduct interviews with at least 15 participants because anything less is generally considered insufficient (Baškarada, 2014; Roy et al., 2015). This single-case study had a predetermined sample size of at least 15 Six Sigma project managers. The Six Sigma project managers had experience enhancing the success of Six Sigma process improvement projects in nonmanufacturing environments at a community college in the Midwest region of the United States. Though I could only recruit and interview eight participants, I collected enough data to reach data saturation.

According to Roy et al. (2015), researchers have an information-rich study through purposeful sampling because of the experiences of the participants. For this qualitative single-case study, I used a sample of eight Six Sigma project managers with process improvement responsibilities and successful experience implementing Six Sigma process improvement projects in nonmanufacturing environments at a community college in the Midwest region of the United States. Through the sample size, I had an

information-rich case because the individuals had experience overcoming Six Sigma

implementation challenges with successful strategies.

According to Fusch and Ness (2015), researchers reach data saturation when there

is enough information to replicate the study, they cannot obtain new information, and

there is no longer a need for coding. Birt et al. (2016) defined member checking as a

technique for validating the interview results and researcher's interpretations. I strived for

data saturation through virtual interviews via Zoom meetings, one phone call, and

member checking. I received enough data in each interview that there was no need for

follow-up interviews. After I audio recorded the interviews, I created the interview

transcripts and wrote what the participants said, and I also used the interview transcripts

for the membership checking process by writing syntheses of the answers to the interview

questions and sending them to the participants. The participants were given a chance to

confirm if the interpretations were inaccurate and to share additional information. This

member checking process continued until there was no need to collect more data.

Sargeant (2012) suggested that participant selection in qualitative research should

be purposeful, and the participants should be able to enhance the comprehension of the

topic being studied and best inform the research questions. To select the participants, I

contacted the community college's Office of Institutional Planning and Research about

the permissible methods of gaining access to the participants. I subsequently recruited

participants who were at least 18 years old, had Six Sigma project management

experience, and had successfully implemented Six Sigma projects.

Ethical Research

Murray et al. (2018) stated that when conducting research, it is imperative to be ethical while working with human participants and provide the informed consent form to participants beforehand. Murray et al. also underscored that the informed consent process is not only legally required but there is also a regulatory and ethical obligation to provide participants with enough details about the case study to ensure that their permission is actually informed. After obtaining Walden University Institutional Review Board (IRB) approval (approval no. 04-13-21-0401256), I sent the participants the informed consent form via email. The form included (a) background information on the study and information pertaining to (b) study procedures, (c) the voluntary nature of the study, (d) the risks and benefits of being in the study, (e) payment, and (f) privacy measures, along with (g) my contact information. Through the email containing the informed consent form, I sent the participants the specific details of the purpose of the study, the procedures of the interview process, and the right to withdraw from the study

Hadidi et al. (2013) discovered that when participants considered withdrawing from studies, the researchers attempted to understand the reasons and offered to be more flexible with the participants. When the researchers could not prevent participants' withdrawal from studies, they asked follow-up questions to understand the participants' obstacles and perspectives for future reference. If participants decided to withdraw from my case study, they would have needed to contact me via email, telephone, or in person, and I would have tried to understand their reasons and encourage them to remain in the study by offering more flexibility. If I were unable to prevent participants from

withdrawing, I would have asked follow-up questions to understand their obstacles and perspectives, so I could learn how to mitigate them, but no participants withdrew from the study. Hadidi et al. found that researchers used incentives like gift cards to retain participants in studies. I also incentivized participants in my study by giving them $10 gift cards to show my appreciation and to retain them.

Wilson et al. (2017) emphasized that participant confidentiality and anonymity are necessary for research to be ethical. To ensure the ethical protection of participants in my case study, I protected their privacy, confidentiality, and anonymity. Before collecting data, I completed the human subjects training offered by the Collaborative Institutional Training Initiative (see Appendix A). According to the U.S. Department of Health and Human Services (2007), a responsible researcher properly stores and protects data from loss, theft, or accidental damage, and the researcher should store the data between 3 and 7 years. I saved the data on a password-protected flash drive and stored the data in a locked storage cabinet for at least 5 years to protect the confidentiality of the participants. Protecting the participants' identities is also vital for ethical research and it is essential to anonymize the names of the participants as well (Saunders et al., 2015). I protected and anonymized the identities of the participants by labeling them "P1," "P2," and so forth on the written transcripts.

Data Collection Instruments

Clark and Vealé (2018) stated that the researcher is the primary instrument for data collection and analysis. During this single-case study, I was the primary data collection instrument and conducted eight semi-structured interviews with Six Sigma

project managers. According to Rimando et al. (2015), the data collection process should

enhance the quality of this single-case study. Data collection is systematic data gathering

for a particular purpose from numerous sources, which include interviews, focus groups,

observations, records, and electronic devices, and the researcher should employ an

interview protocol, which is a set of rules and guidelines for the interviews (Dikko, 2016;

Rimando et al., 2015). To enhance the quality of this single-case study, the data

collection process consisted of audio recording the semi-structured interviews and using

open-ended questions (see Appendix B). In addition to the interview questions, I

followed an interview protocol for each participant as well (see Appendix C). Birt et al.

(2016) underscored that the researcher enhances the reliability and validity of the data

collection process by employing member checking. The method of member checking is

beneficial because participants validate the data interpretations and results. To ensure the

reliability and validity of the data, I employed the member checking method by allowing

the participants the opportunity to validate the data interpretations and results.

Data Collection Technique

According to Castillo-Montoya (2016), the qualitative researcher should obtain

detailed and rich data to understand the participants' experiences. Through the data

collection technique of face-to-face, semi-structured interviews, the researcher can obtain

detailed and rich data and the descriptions and meaning of the participants' experiences.

The interview protocol is a vital tool for the case study because it is a set of guidelines

and rules that researchers use to conduct interviews (Dikko, 2016). I used semi-structured

interviews as the data collection technique for the single-case study, and I applied the

interview protocol (see Appendix C). I obtained detailed and rich qualitative data through semi-structured interviews to understand the participants' experiences, the descriptions of their experiences, and the meaning of their experiences as well.

Hancock and Algozzine (2016) stated that semi-structured interviews are ideal for case study research because the researcher asks predetermined questions that are flexible and open-ended for participants to express themselves freely. The advantages of using semi-structured interviews as the data collection technique are open-ended questions that are flexible, and I provided an environment where participants expressed themselves openly. The disadvantages of this technique were the limitations of interviewing eight participants and the possibility that eight participants would not have provided enough data, but I collected a sufficient amount of data regardless.

According to Yin (2014), a pilot case study is a preliminary study that the researcher implements to develop, test, and refine planned interview questions and procedures that will be used in the formal case study in the future. Yin also stated that the researcher should not use the pilot study's data in the formal case study. After receiving IRB approval, I opted not to conduct a pilot case study because I was concerned about recruiting enough participants. I decided to use all my interviews for the planned case study.

Member checking is a method to validate the data from interviews (Birt et al., 2016). I used member checking to validate the data from interviews by emailing each participant my interpretations of the interviews so they could have the opportunity to

validate the information. I gave all participants the opportunity to review, correct, and validate my interpretations after they were interviewed.

Data Organization Technique

According to Chowdhury (2015), qualitative data analysis should start by listening to the participants, and the researcher should organize data by transcribing, reading, and coding the observational data and recorded interviews. Researchers use reflective journals to collect data in qualitative research to obtain data about the feelings of the participants as well (Bashan & Holsblat, 2017). I used an audio recording device while interviewing and listening to the participants either virtually or on the phone, and I took additional notes to capture the feelings of the participants. I used Microsoft Word to track, transcribe, and code the data, and through the coding process, I identified phrases and common themes from the interview data for further analysis.

According to The U.S. Department of Health & Human Services (2007), researchers should properly store and protect data between 3 and 7 years. I stored all raw data on a password-protected flash drive for 5 years. After 5 years, I will delete all data from the password-protected flash drive to comply with the IRB requirements, and I will protect the confidentiality and privacy of the participants by deleting all raw data after 5 years.

Data Analysis

According to Fusch and Ness (2015), methodological triangulation is collecting multiple data sources that will improve the reliability of the results. Brown et al. (2015) highlighted that the researcher should promote rigor, gain a deeper understanding of the

data, and develop a more complete picture from the data. For the single-case study, my

goal was to use methodological triangulation to improve the reliability of the results. I

wanted to use data from interviews, project meeting documents, and archival documents

to promote rigor, gain a deeper understanding of the data, and develop a more complete

picture of the case study, but I was only able to use data collected from the interviews due

to the college's privacy policy. I reached data saturation though.

Bowen (2005) accentuated that researchers use inductive analysis of interview

transcripts to identify codes and themes. I applied inductive analysis to identify the codes

and themes from the interview data. Leech and Onwuegbuzie (2007) stated that

researchers use constant comparison analysis to analyze entire datasets in order to

identify themes presented through the data. The researcher reads the entire dataset,

organizes the data into smaller meaningful parts, labels each chunk of data with a

descriptive title or code, and compares each new chunk of data with the previous codes

(Leech & Onwuegbuzie, 2007). After coding the data, the researcher groups the codes by

similarity and identifies and documents a theme based on each grouping (Leech &

Onwuegbuzie, 2007). After I read the interview data to get a general understanding, I

coded the interview data in Microsoft Word. I used inductive coding, segmented the data

into smaller meaningful parts, and labeled the segments with descriptive codes that

emerged from the data. After I completed the coding process in Microsoft Word, I

transferred the data to a Microsoft Excel spreadsheet to conduct a deeper analysis. I used

the Microsoft Excel spreadsheet to record the codes for each participant and label similar

segments of data with the same code. I organized the participants, interview questions,

interview responses, and codes in separate columns, so I could filter and sort the data, and compare the responses and codes. I grouped the codes by similarity and identified subthemes and themes based on each grouping. After I developed the subthemes and themes, I summarized them to present the findings of this constant comparison analysis and used the Excel spreadsheet to continue identifying and analyzing themes.

Burnard et al. (2008) illuminated that the researcher is responsible for explaining the data by exploring and interpreting the data. The last step I took was interpreting the data. During this step, I gave my interpretations of the findings. I also compared and correlated the key themes from the interview data with the themes I researched from the literature review and the TQM conceptual framework. Lastly, I explained the theme correlations with the literature, elucidated new studies since writing the doctoral study and the conceptual framework, and presented the findings in Section 3.

Reliability and Validity

Dependability

Dependability refers to the consistency and constancy of the data over time and conditions (Cope, 2014). Using the method of member checking will ensure dependability and validity (Dikko, 2016; Yazan, 2015). To ensure dependability and validity, I used the method of member checking by allowing the participants the chance to review the interpretations of the interview question responses. The participants were given the opportunity to confirm whether my interpretations were accurate or not.

Credibility

Credibility refers to the truth of the data and views of the participants (Cope, 2014). Dikko (2016) relayed that researchers can ensure credibility through the method of member checking to verify the research findings. To ensure credibility, I also allowed the participants to review the interview interpretations and have the chance to verify the research findings through member checking.

Transferability

According to Cope (2014), a qualitative study is transferable when the readers can relate to the results with their own experiences and when the results have meaning to people who are not involved in the study. Greene (2014) stated that researchers can make sure a study is transferrable by using thick descriptions based on taking detailed notes of the research setting and context. To ensure transferability, I used thick descriptions based on taking detailed notes of the research setting and context so the readers could relate to the results.

Confirmability

Confirmability refers to the researcher demonstrating that there are no biases, and that the data represent the participants' responses (Cope, 2014). Confirmability also ensures that the qualitative research process is dependable and reliable (Livingston et al., 2015). I demonstrated confirmability by describing how the interpretations, findings, and conclusions were directly from the data and were unbiased.

Data Saturation

A researcher reaches data saturation when there is sufficient information to replicate the study and when the researcher cannot obtain new information (Fusch & Ness, 2015; Hancock et al., 2016). Data saturation occurs when further coding is no longer practical as well (Fusch & Nes, 2015). I ensured data saturation and obtained sufficient information through the interviews.

Transition and Summary

In Section 2 of this doctoral study, I presented the purpose statement of my qualitative case study, a detailed explanation of the role of the researcher, the specifics of the participants, research method and design, population and sampling, and ethical research. Section 2 also contained the data collection instrument, data collection technique, data organization techniques, data analysis, and reliability and validity. In Section 3, I will cover the presentation of the findings, application to professional practice, implications for social change, recommendations for action, recommendations for further research, my reflections, and the conclusion.

Section 3: Application to Professional Practice and Implications for Change

Introduction

The purpose of the qualitative case study was to explore the strategies project managers used to implement successful Six Sigma process improvement projects in nonmanufacturing environments. The study consisted of participants who had Six Sigma green belt and black belt training and experience implementing Six Sigma at a community college in the Midwest region of the United States. I collected data from semi-structured interviews. Due to the college's confidentiality policies, I could not include additional data from project meeting notes, project documents, or other archival documents, but I collected sufficient data to answer the research question.

In Section 3, I present the findings, which are encapsulated in 15 themes. The themes illustrate how to implement successful Six Sigma process improvement projects in nonmanufacturing environments. I tie the study's findings to the TQM conceptual framework and literature review. The section also includes discussion of applications to professional practice and implications for social change, as well as recommendations for action and further research.

Presentation of the Findings

Though my goal was to conduct at least 15 semi-structured interviews, I was only able to recruit eight participants, but I reached data saturation. I conducted seven virtual interviews via Zoom and one interview via phone call to answer the research question of the study, which was, What are the strategies project managers use to implement successful Six Sigma process improvement projects in nonmanufacturing environments?

The names of the participants were replaced with codes in the transcripts (P1, P2, P3, P4, P5, P6, P7, and P8). In the study, I used the constant comparison analysis method where I read the interview transcripts to gain a general understanding of the data. I also identified the codes and themes from the interview transcripts. Researchers apply the constant comparison analysis method, which is an inductive process of thematic analysis, to categorize and compare qualitative data (Thompson et al., 2021). Constant comparison analysis entails six methodological steps: the researcher being immersed in the data, developing an initial thematic template, organizing the data based on the template, condensing and reflecting on the data, comparing and contrasting the data with similar participant categories, and comparing and contrasting the data with different participant categories (Thompson et al., 2021).

After reading the interview data, I coded the data in Microsoft Word, segmented the data into smaller meaningful parts, and labeled the segments with descriptive codes that emerged from the data. After I completed the coding process in Microsoft Word, I transferred the data to a Microsoft Excel spreadsheet to conduct a deeper analysis. I organized the participants, interview questions, interview responses, and codes in separate columns so I could filter and sort the data and analyze and compare the responses and codes. I grouped the codes by similarity and identified subthemes and themes based on each grouping. After I developed the subthemes and themes, I summarized them to reveal the findings of this constant comparison analysis. To ensure the reliability and validity of the data, I also employed the member checking method by allowing the participants the opportunity to validate the data interpretations and results.

After identifying the subthemes and themes from the data, I developed my interpretations of the findings, which follows. I also provide a critical analysis of the key themes from the interviews, the themes I researched from the literature review, and the TQM conceptual framework. In this subsection, I present the findings, explaining how the 15 identified themes correlate with the previous literature and with new studies published.

Theme 1: Selection of Projects Based on Leadership Approval and Institutional Priorities

In the TQM conceptual framework that I presented in the study's literature review, I underscored project selection guidelines. According to Padhy (2017), the first phase of project selection should be identifying projects by generating ideas from management, technicians, or operators. Selecting projects based on leadership or management approval and institutional priorities helps set Six Sigma projects up for success. The first theme was selection of projects based on leadership approval and institutional priorities.

The first subtheme that emerged under Theme 1 was select projects based on leadership approval. P1 stated that "black belts would need approval from the community college's cabinet before initiating projects." P5 agreed that "leadership at the college was instrumental in project selection, and that "vice presidents and deans would recommend projects." P5 expressed that it was important for leadership to help select and approve projects because they would examine "the needed resources to initiate them" and examine the "timing to initiate them as well." Motiani and Kulkarni (2021) also found in

a literature review that leadership was one of the critical success factors for a LSS

implementation. A successful LSS implementation should have project selection and

prioritization processes that are guided by leadership and institutional or organizational

priorities.

As I discussed in the study's literature review, Yousefi and Hadi-Vencheh (2016)

found that practitioners should initiate Six Sigma projects that meet a company's strategic

goals. The second subtheme that emerged under Theme 1 was to select projects based on

the strategic plan and institutional priorities. P3, P4, and P5 all agreed that Six Sigma

projects at the college were selected based on the strategic plan. P3 shared that "Six

Sigma projects were guided under the strategic plan, and the black belts were the face of

the Six Sigma projects." P4 elucidated that the "projects came from two directions:

strategic planning and annual operational planning," and "during the planning process,

leadership would identify the needs for the projects."

Theme 2: Selection of Projects Based on Opportunities for Improvement

The second theme was selection of projects based on opportunities for

improvement, and I also covered the theme in the TQM conceptual framework of the

study's literature review. Adebanjo et al. (2016) identified criteria for Six Sigma project

selection and noted that the selection of projects should also be based on cycle time

reduction and improving compliance and controls.

The subtheme that emerged under Theme 2 was select projects based on rework,

manual processes, and other opportunities for improvement. P6 suggested that

practitioners should "select projects that have tasks that are repetitive or have rework and

manual tasks that take extra time to complete in order to minimize errors and reduce time to execute them." P7 "conducted benchmarking activities, collected data, and did research to define their current states for projects, and the activities helped them discover and select projects with processes that would give them quick wins, take more time, or cost more money." The findings align with those of Singh et al. (2022), who found that having the ideal critical to quality factors in LSS project selection will reduce waste, rework, and unnecessary movement of material and employees. These are critical customer requirements that project managers should consider when selecting Six Sigma projects (Singh et al., 2022).

Theme 3: Role of Leadership in Selecting Project Team Members

Gijo et al. (2021) conducted a literature review and found that one of the critical failure factors in implementing Six Sigma projects is the "incompetent team." This incompetent team primarily emerges due to the lack of attention toward project team dynamics and the lack of a project team selection methodology. This critical failure factor underlines how imperative it is to apply the third theme, which is the role of leadership in selecting project team members.

The subtheme that emerged under Theme 3 was leadership should recommend team members and SMEs (subject matter experts). P5 said that "the community college's executive cabinet would recommend subject matter experts if needed and recommend others they thought should be involved." After the community college hired a new president, they discontinued the former Six Sigma framework that was under the previous president. The new president implemented a framework that had a Six Sigma foundation,

but it was tailored to fit the needs of the community college. College leadership called this new framework "investigate, design, implement, and deploy" (IDID), and it was focused on the strategic plan. P6 shared that under the new IDID framework, "leadership created strategic teams to focus on struggling areas like completion rate, college and career readiness, accountability, and data." Bhat et al. (2022) echoed these findings when they emphasized the importance of selecting the right people for LSS projects, but they leaned toward middle management in making project team selections. Bhat et al. specifically stated that selecting the right people for LSS projects was the prime responsibility of middle-level management not just upper-level management. Though the participants of this case study expressed the importance of upper-level management, like the executive cabinet, selecting project team members, none mentioned how middle managers were involved in project team selection at the community college. This oversight could have contributed to middle managers not feeling like they had buy-in, which could have been one of the root causes of why some of the participants experienced resistance from middle managers at the college when implementing Six Sigma.

Theme 4: Selection of Internal and External Project Team Members

The fourth theme was selection of internal and external project team members. The first subtheme that emerged under Theme 4 was project sponsors should be on project teams. Adeinat et al. (2021) expressed the importance of having project sponsors for LSS projects because they ultimately approve the project charters. Project sponsor roles should be clearly comprehended at the right levels of a company, and the project

sponsors should clearly understand the fundamental LSS concepts, techniques, and tools, so they can effectively support the LSS methodology (Davidson et al., 2020). Antony et al. (2021) emphasized that during the Define phase of Six Sigma, project teams should leverage project sponsors to develop and refine the problem statement, determine the project cope, and give the objectives of the project.

The participants in the study also understood the role of and experienced the value of project sponsors for Six Sigma projects. P7 highlighted that "it is important to get a project sponsor for a project, especially in order to get resources because the sponsor will know how to get more resources to help the project." P4 also communicated that the black belt or the green belt would work with the project sponsor to develop the project charter, and project sponsors were at least at the director level.

The second subtheme that emerged under Theme 4 was selecting cross-functional project teams. P1 expressed that the community college "always had a process owner on the team and picked one or two people from inside the process area, and they invited other people outside of the process from other departments." Process owners are vital to a project because they are responsible for documenting and standardizing the process, approving process improvements, and ensuring changes to the process do not affect other processes and process partners in a negative way (Hrabal et al., 2020). P4 said that "process owners, who would present a business case for a project, would recommend team members as well. P4 indicated that "there was always a process owner on a project and a FREP (financial representative)." P6 concurred with P1 and said the "project teams that were formed were primarily cross-functional." When P6 "began at the college, there

were a lot of silos," and she wanted "to include key people and teams because the silos can create major problems down the road for the other teams." Bhat et al. (2022) promoted cross-functional teams in their study because cross-functional teams can help complete a project successfully, generate ideas for quality initiatives, and achieve objectives more efficiently. They also recommended a mixed team, excluding the champion and process owner, of four to six people from various functions and departments.

The third subtheme that emerged under Theme 4 was information technology representation. P2 expounded that "the technology department changed the college's processes, and it is important to include technology/information technology in every project." "Every project had a technology member to help identify and implement realistic and plausible technological solutions." P1 agreed that projects "would have someone from technology on the teams also. "Most projects wanted new technology, or they would want to fix the student database to make processes more efficient for our students."

Theme 5: Selection of Project Team Members With Six Sigma Expertise

In the TQM conceptual framework of the study's literature review, I analyzed the different Six Sigma roles like black belt and green belt. The fifth theme was selection of project team members with Six Sigma expertise. Antony and Karamina (2016) found that the most important roles and skills of a black belt are being skilled in DMAIC tools and techniques, statistical analysis, and a change agent who also has effective soft skills. In the study's literature review, I also highlighted how Marzagão and Carvalho (2016)

found that having clear roles in the Six Sigma structure, full-time black belts, and clearly allocated green belts were keys for optimal project performance.

The subtheme that emerged under Theme 5 was select yellow belt-, green belt-, and black belt-trained team members. Antony et al. (2022) stated that to deploy Six Sigma successfully, the company needs a clear and specific infrastructure that includes master black belts, black belts, green belts, and yellow belts. P8 also revealed that "a good strategy is having a well-trained and experienced black belt on the team to help with effective conflict resolution and to mitigate the resistance." P2 expressed that "black belts would primarily leverage trained green belts, yellow belts, and the 'dark' green belts. 'Dark' green belts were more experienced than the average green belts." P1 illuminated that "to be green belt certified, a person had to serve on a project team and run a project team, and green belts were always included on project teams also.

P6 expanded on the challenges of Six Sigma when project teams do not have Six Sigma knowledge or expertise. P6 declared that "one of the challenges of applying Six Sigma, is working with people who have no understanding of the methodology or who have been in silos for so long. These issues can cause projects to fail." The project challenges that P6 mentioned, that are due to lack of expertise on projects, are plausible because desired project results can be critically influenced when a project team has expertise in the LSS tools and techniques, project prioritization, and project management (Singh et al., 2022).

Theme 6: Offering of Six Sigma Training

The sixth theme was offering of Six Sigma training. Six sigma training is imperative for the success of Six Sigma projects, but it comes at a cost. Mueller and Cross (2020) found that Six Sigma training for an individual costs between $10,000 and $60,000 depending on the belt level, and the cost of training is a waste if the person does not apply the Six Sigma methodology to improve company processes. Despite the high costs for Six Sigma training, the costs could be justified if there is higher adoption and enhanced business processes by increasing the deployment of the Six Sigma methodology and tools.

The first subtheme that emerged under Theme 6 was to offer training for different levels. P1 and P4 mentioned that the college had a "partnership with Caterpillar Inc. All black belts went through Caterpillar's Six Sigma black belt training." P4 detailed that the "black belt training provided by Caterpillar spanned 4 months, 1 week a month, and black belts in training used storyboards to report on project progress." P4 also communicated that "the yellow belt and green belt trainings at ICC were contextualized for the community college setting" even though their black belts were trained at Caterpillar. P5 said that "master black belts who trained the black belts at Caterpillar would check in with the black belts at the community college regularly regarding their trainings and projects." P4 also said that "black belt training was problem-specific. You came in with an actual project in a workshop setting and were given a lot of feedback on the structure of your project. You would report back to the group about the progress of the project as well."

P1 revealed that the community college offered white belt trainings, and P2 explained that the college offered yellow belt and green belt trainings also." The yellow belt trainings were four 2-hr sessions, and the green belt trainings were four 4-hr sessions, once a week, every Friday morning. P2 shared that "though the yellow belts and green belts were trained, they were not required to manage a project," but P8 recalled that "in her experience, the most helpful training approach was expecting them to do mock projects in green belt training."

The second subtheme that emerged under Theme 6 was black belts trained team members during the project. P2 also stated that "the trainings were facilitated by black belts." P3 noted that "training happened during the recruitment process from the black belt. It was like on-the-job training; learning and applying the Six Sigma tools like process mapping. The black belt did a great job explaining the purpose, the goal, and how they planned to execute the project." P7 highlighted her own approach to training team members. She would "schedule a meeting with team members to educate them about the purpose of the tools and how they will benefit from the project before they applied the tools." In the study's literature review, I uncovered some drawbacks to offering Six Sigma training as well. Ozkan et al. (2017) found that even though companies have benefited from Six Sigma, some companies committed billions of dollars to Six Sigma training and were left with overloaded staff levels. I also shared in the study's literature review that some black belts left companies for highly paid jobs at competitor companies after receiving Six Sigma training and executing projects, which caused an issue in finding qualified candidates to manage Six Sigma projects (Antony, Gijo, et al., 2016)

Theme 7: Clear Communication

In the TQM conceptual framework that I presented in the study's literature review, Habbal and Jreisat (2018) unveiled that poor communication between departments was one of the major implications that prevented the success of TQM applications in higher education. The seventh theme was clear communication. In the study's literature review, I also shared that clear communication about LSS initiatives and helping employees clearly understand LSS were critical success factors for a Six Sigma implementation (Knapp, 2015).

The first subtheme that emerged under Theme 7 was to clearly communicate. P3 and P6 agreed that clear communication was a key to overcoming roadblocks like resistance. P3 said she "received a lot of resistance from hiring managers and deans during one of her recruitment process improvement projects", but she "made her process more transparent to overcome the resistance." P6 shared that "it was important to help people understand 'why' we needed to make the change in the process and what the benefit was." This subtheme aligns with Bhat et al. (2019) who found that critical success factors of upper management like involvement and commitment, organizational belief, vision and culture, and regular and clear communication were necessary in a LSS implementation.

The second subtheme that emerged under Theme 7 was to meet one-on-one with the project sponsor, process owner, and leaders. P6 communicated that "anytime she had resistance, she would meet one-on-one with the process owner or the department leader." P7 also highlighted that "if there was group resistance, she would ask the project sponsor

to address the group to give the team a boost, and she would revisit the importance and value of the project." P3 declared that "strategies may not completely overcome resistance depending on how deep the culture of resistance is." From P3's experience, "some faculty were concerned about losing their jobs because of the process improvements, which caused resistance as well." Employee resistance is a major barrier to a Six Sigma implementation, and clear communication is a key strategy to overcome this barrier (Ali et al., 2020).

Theme 8: Provision of Additional Training and Expertise Outside of Six Sigma

In the study's literature review, Laux et al. (2015) found that to enhance the success of Six Sigma projects, project managers should receive project management training and apply project management skills. The eighth theme was provision of additional training and expertise outside of Six Sigma. The first subtheme that emerged under Theme 8 was project management and change management training. P5 stated that "one of the biggest challenges, as the projects were rolled out, was outstanding improvements that never got implemented and why." Offering project management training to Six Sigma project managers would have helped implement and sustain improvements. Singh et al. (2022) also found the need for project management skills to drive the desired results in Six Sigma. Zanezi and Carvalho (2023) discovered that many authors have argued that project management capabilities should be incorporated into LSS to become successful. P5 said that "implementing a more project management style in the Six Sigma program and requiring black belts to help process owners develop implementation plans and staying with them to implement improvements would enhance

project success rates as well." P7 concurred because she "experienced successful projects where she used her Project Management Professional certification." P7 believed that "as a project manager, it is important to have a very diverse toolbox because every project cannot be executed the same."

Vaishnavi and Suresh (2020) found that effective LSS requires project management and change management. Project management should focus on the activities to meet project requirements and change management should focus on the human side like communication, coaching, individual development, training, and reducing resistance. Change management training was also a key strategy that I found in the study, and the participants specifically mentioned the benefits of Proci's ADKAR change management training, which stands for awareness, desire, knowledge, ability, and reinforcement. P5 shared that the lack of "change management was a challenge. Though the improvements were great, the lack of buy-in and change management strategies caused obstacles in implementing improvements." P5 said that "resistance was not about the improvement, but the time to make the changes with their teams." P5, P6, and P7 underscored how college leadership added ADKAR to the new IDID framework, and they also had some people become official change management practitioners on some projects." From P6's perspective, "the former Six Sigma program did not have a formalized change management framework like IDID. College leaders knew how to make a better process, but struggled with the execution of ideas because they did not have full adoption from others, which is the goal of change management."

Theme 9: Presentation and Validation of Improvements to Key Stakeholders

The ninth theme was presentation and validation of improvements to key stakeholders. The subtheme that emerged under Theme 9 was to be fact-based and data-driven. Rejikumar et al. (2020) stated that a data-driven approach can help managers understand emerging trends in the business context and develop strategies to give them a competitive advantage. It is critical for managers to have the skills to think analytically to obtain accurate insights, but some managers think that LSS metrics are too complex to leverage or understand, which discourages them from adopting data-driven approaches like LSS. Despite how difficult a fact-based and data-driven approach like Six Sigma can be, companies should adopt the methodology for quantifiable results.

P1 communicated that data were especially important in Six Sigma projects. P1 said that "whether it was a cost saving, time saving, or material saving, we had to dig deep into process data and show that data to prove it to key stakeholders." P1 also articulated "that presenting fact-based and data-driven improvements helped overcome resistance." P3 leveraged process data "to push back on people and make her case when needed." P8 agreed that "taking the time to research and collect the process data needed to back things up was a strategy to enhance the success rates of projects also." P2 used project dashboards "to present and validate her process improvements and keep Six Sigma projects in front of the people and to communicate with them." P2 mentioned that "the college uses dashboards today to track outcomes and the results of the projects."

Theme 10: Leveraging of the Six Sigma Toolbox

The 10th theme was leveraging of the Six Sigma toolbox. Based on the TQM conceptual framework in the study's literature review, Six Sigma project managers should have expertise in the DMAIC tools and techniques (Antony and Karamina, 2016). Having Six Sigma project managers with the knowledge of and experience applying the tools and techniques is essential to a successful Six Sigma implementation.

Definition of Business Problems During the Define Phase

The first subtheme that emerged under Theme 10 was to define business problems in the Define phase. P3, P4, P6, and P7 expressed the importance of beginning Six Sigma projects by defining business problems and implementing the tools in the Define phase of the DMAIC approach to improve processes and enhance the success rates of projects. P3 believed the Define phase "truly helped improve the process", and P4 highlighted that the Define phase was key because it helped him articulate the business case and identify the pain points in the process." P6 leveraged the Define phase because she "wanted to dig into the current state and delta state in order to knock down as many roadblocks to get to the future state."

Though the project managers successfully executed the Define phase, P4 revealed that the college was not strong in the Measure phase or process measurement. P4 said, "The Measure phase was a bit fuzzier because the college was not as practiced in thinking of process outputs, quality indicators, outcome indicators, or really thinking of what the student and stakeholder need from this process in order to present a set of measures from their critical customer requirements and quantitatively define the

process." Hollingshed (2022) also found that service companies did not apply many tools from the Measure phase since they did not have processes that required heavy statistical analysis.

Process Mapping and Value Stream Mapping

The second subtheme that emerged under Theme 10 was process mapping and value stream mapping. Process mapping and value stream mapping are two important tools in the Six Sigma toolbox to improve processes and enhance the success rates of projects. According to Chiarini and Kumar (2022), process mapping and value stream mapping are key tools to evaluate and improve processes, collect data, and integrate and automate processes. P1 shared that her team "process mapped everything, looked at the current process and where they were going to measure, looked at where they were going to pull data, and then they pulled the data and started breaking the process down." P1's project teams would focus on "how the college could save time and money, and what they wanted the process to look like." They also used process mapping to help "identify the technology in order to improve the processes." P3, P4, P5, and P7 all underscored the value of process mapping. P4 specifically mentioned the benefits of tools like a SIPOC Diagram and a Spaghetti Diagram. P4 communicated that "mapping tools like the SIPOC was a successful tool to create a lot of engagement. Before creating a process map, leveraging the SIPOC by focusing on the suppliers, inputs, outputs, and customers of the process at a high level was beneficial." P4 noted that "the Spaghetti Diagram was a useful tool to show how complex a process was as well."

P5 and P7 applied value stream mapping in their process improvement projects. P5 highlighted that her project teams used the DMAIC and define, measure, explore, develop, and implement (DMEDI) methodologies, and they spent a lot of time in the Define phase. P5 expressed that "nonmanufacturing processes at the college were not documented well. They used value stream maps and sticky-note process mapping and brought the process owners in for workshops to learn more about the processes." According to P5, "process maps really didn't exist at the college until the implementation of the Six Sigma program in the early 2000s." She shared that "process mapping, value stream mapping, and spending a lot of time in the Define phase were beneficial because they were able to create standard work through the projects. Hundal et al. (2022) found that process mapping and value stream mapping are essential LSS tools as well, and the tools contribute to waste elimination and processes that were reliable and efficient.

Leveraging of the DMAIC and DMEDI Methodologies

The third subtheme that emerged under Theme 10 was to leverage the DMAIC and DMEDI methodologies. According to Pacagnella Junior et al. (2023), Six sigma project managers use the DMAIC approach to improve existing processes, products, and services, and they use the DMEDI approach to design new processes, products, and services. Though P2 indicated that she primarily employed the DMAIC approach, P3 highlighted how she leveraged DMAIC to improve processes and DMEDI to design a new office and processes in the college. In addition to leveraging the Six Sigma toolbox, P7 stressed the benefits of using the LSS toolbox as well. P7 expressed how using this

hybrid methodology and tools like 5S helped her improve processes and enhance the success rates of projects as well.

Gate Reviews

The fourth subtheme that emerged under Theme 10 was gate reviews. Tollgate or gate reviews are project status reports that keep key stakeholders updated about the progress of Six Sigma projects after each phase has been executed. P2 revealed that "the strategy that worked the best was gate reviews at every step or phase of the Six Sigma process. The gate reviews would be hosted by black belts in the performing arts center auditorium with 150-200 people. They hosted morning and afternoon sessions where black belts would give status updates for projects. The gate reviews were all employee sessions to explain the progress of projects and next steps. They would provide forms for people to fill out regarding the projects:

- Green light = Keep going.

- Red light = Did you know this was really happening at the institution too?

- Yellow light = Slow down and talk to these people first before going any further.

P2, P4, P5, and P7 mentioned the value of gate reviews to help clearly communicate project status reports to not only employees but also leadership and key stakeholders. Though gate reviews are an effective project management approach, Louzada et al. (2022) found that tollgate reviews or gate reviews can be a technique that is less observed by project managers.

Process Measurement and Control

The fifth subtheme that emerged under Theme 10 was process measurement and control. The Measure phase in Six Sigma DMAIC is a particularly important phase to collect baseline process data and track key performance indicators and metrics to measure process performance in the current state of a process. Singh et al. (2022) stated that the Measure phase was leveraged to explore the current state of a process and identify the root causes of inefficient processes. P4 "provided a sustainable measurement support for a process owner to regularly pull and analyze process data, which also helped enhance the success rates of Six Sigma projects." P5 expressed that "black belts had the responsibility to follow up with the process owners and create control measures with project teams to check process performance and collect qualitative data about process performance as well."

In the Control phase, process performance is also measured in the future state with the goal of sustaining process improvements. Latessa et al. (2021) explained that the purpose of the Control phase is to monitor the process and ensure that improvements are sustained. After the improvements were implemented in projects, P4 and P5 stressed the importance of a process control plan. P4 said that "at the black belt level, a responsibility was to have a process control plan or designated checkpoints to follow up with process owners and project sponsors to check on the Control phase activities. The checkpoints would be documented in the project charter, and he and his project teams would make formal assessments to determine if the project was in control or not. The control checkpoints were about every 6 months or twice a year." P5 shared that "getting a good

control plan, which was a template that defined metrics and helped the process owners track them, helped with implementing improvements as well."

Theme 11: Leadership and Stakeholder Buy-In

In the TQM conceptual framework from the study's literature review, I referred to Huq (2017) who studied two companies where Six Sigma was implemented successfully and unsuccessfully. Huq found that companies, which had project teams with leaders who were not stagnant but empowered their employees and Six Sigma project teams, experienced success when implementing Six Sigma. The 11th theme was leadership and stakeholder buy-in.

The subtheme that emerged under Theme 11 was getting buy-in helps people adopt Six Sigma and enhance project success. Trakulsunti et al. (2020) found that effective leadership is required for a successful LSS implementation. Leaders must communicate the LSS vision to people at different levels of the company, get commitment, and create a culture of LSS by getting buy-in. The participants agreed with the need to get buy-in as well. P2 stated that "all of the vice presidents and executive directors at the college were green belt trained before ever deploying a project." P6 "made sure she had buy-in from her entire team and had adoption to successfully complete the project and implement the changes." She said that any problem in financial aid, the registrar's office, and so forth affected student financial services, which was her department, and became her problem. Her approach to helping them identify their pain points increased her chances of success because she had already gotten their buy-in. P7 also pointed out that "getting the buy-in from key stakeholders as you progress in the

project is helpful because they may redirect you if the team is off-track or if there is

scope creep."

Theme 12: Implementation of a Process Management Plan

The 12th theme was implementation of a process management plan. The

subtheme that emerged under Theme 12 was effective process management after project

handoff. P4 believed that effective process management after handoff was key to

sustaining Six Sigma implementations. He illuminated that the "sustainability of Six

Sigma project implementation at the college was a challenge because there was no

effective process management after the handoff." This viewpoint was diametrically

opposite to P8's experience at the college though. P8 shared that "they had specific teams

to monitor and control the processes and ensure that the solutions were working after the

project was handed off to the process owner." P8 explained that "projects that were 15

years old were being monitored." P4 also said that "having a central repository of how a

process is documented and measured is another recommendation for effective process

management."

Theme 13: Revisitation and Reevaluation of the Process

The 13th theme was revisitation and reevaluation of the process. The subtheme

that emerged under Theme 13 was process check-ins. P3 indicated that "the quarterly

review of the recruitment process helped her to assess the success of her Six Sigma

strategies." P3 used "process data analytics like pie and bar charts to report the

recruitment process's progress as well." P6 highlighted that "checking in with her team

regularly to understand progress helped her sustain the implementation of changes." P7

believed strongly that her "check-ins helped the success of the project by reviewing the charter, verifying the scope, and ensuring goals were the same." P7 also shared that "sustaining success on any project requires consistent check-ins to evaluate the progress and what is working well and is not working well." Lavin and Vetter (2022) also found that effective check-ins were monthly, and the project manager assigned specific deliverables at each check-in to be effective as well.

Theme 14: Collection of Feedback Through Surveys

The 14th theme was collection of feedback through surveys. The subtheme that emerged under Theme 14 was collection of feedback from key stakeholders through project surveys. To improve the success rates of Six Sigma projects, surveys are important to implement. P1 used student surveys to receive project feedback and ensured that they were short surveys. P2 emphasized the benefits of collecting feedback through "climate surveys." P2 said she "implemented climate surveys to examine if her project teams were using the right approaches in her projects." P2 also highlighted that her teams "surveyed primary and secondary stakeholders to get feedback, and they did not care if the feedback was unpleasing." P8 concurred with P1 and P2 that "project teams would use surveys for students, faculty, and staff to assess the success of Six Sigma projects. They received quite a bit of feedback to ensure they were doing things correctly in case they needed to make changes. They also monitored the website inbox for process feedback to ensure there were no more complaints."

Theme 15: Reassessment and Tailoring of the Six Sigma Framework to the Needs of the Organization

The 15th theme was reassessment and tailoring of the Six Sigma framework to the needs of the organization. The subtheme that emerged from Theme 15 was the IDID framework. By the time P3 was hired by the community college in 2015," the college was not maximizing Six Sigma projects at their fullest capacity, but they were training yellow belts." P3 explained "that after the state budget impasse, it affected the school's Six Sigma budget and how they deployed the methodology. The college had black belts, but eventually phased the program out and transitioned to the IDID framework." P4 revealed that "some people were not completely bought into the DMAIC methodology, but the new president knew that they needed to have a process improvement framework. As a result, a steering committee created the acronym called IDID, which would be the framework to support and achieve the strategic plan." P4 also shared that "though the new president implemented IDID, the principles of Six Sigma were foundational to the new framework."

P6 offered a critique of the new IDID framework that was different than the experiences of P3 and P4. P6 clarified that "the strategic objectives in IDID compared to the previous Six Sigma program were very broad, which caused the Investigate stage to take more time to define the problems, unlike Six Sigma, when a business problem was already identified." P6 said that "this new approach caused the first phase of Investigate to be extremely long."

Applications to Professional Practice

The study's findings could be of value to business managers who are planning to implement or have implemented the Six Sigma DMAIC process improvement methodology in nonmanufacturing environments. LSS has tools that project managers can implement and significantly improve manufacturing, service, education, and other processes. (Antony et al., 2021). Because Six Sigma can be challenging to apply for some project managers, business leaders can learn how to successfully implement the methodology in nonmanufacturing environments through the study. People do not need to have advanced knowledge of statistics or operations management to apply the LSS DMAIC methodology for process improvements because LSS has many tools that can be leveraged simply and effectively.

I identified applicable strategies, tools, and techniques in the study because the participants did not manage projects focused on statistically heavy processes. McDermott et al. (2022) found that LSS is a proven operational excellence methodology in different sectors like manufacturing, service, healthcare, and others. LSS has broad application tools that can be used to improve companies' products, processes, and services by reducing costs, eliminating waste, and helping staff become more efficient and effective.

Implications for Social Change

Through the study, I expect the findings can help project managers enhance their companies and reduce the costs of poor quality by improving business processes and services through Six Sigma. In a study about LSS projects in healthcare settings, the projects resulted in cost reduction and quality improvements (Sordan et al., 2023).

Murmura et al. (2021) found that LSS is a proven methodology for optimizing company profits and gaining a competitive advantage. Through the cost savings from the application of Six Sigma, company leaders can allocate a percentage of their profits to nonprofit organizations to help underprivileged people through education, employment, housing, and financial programs.

Yang (2021) researched that nonprofits play a vital role in responding to the issues and needs of the most marginalized and vulnerable people, and nonprofits play a significant role in addressing the social problems in this world. When nonprofit organizations enhance the lives of underprivileged people through education, employment, housing, and financial programs, they can improve communities. If implemented correctly and successfully, project managers can leverage Six Sigma to improve their companies' profits, company leaders would be able to donate more of their profits to nonprofit organizations, and nonprofit organizations can use the profits to effect social change!

Recommendations for Action

The first recommendation for business leaders and project managers who are implementing Six Sigma is to select projects based on leadership approval and institutional priorities. It is important that Six Sigma projects add value to the company and its customers. Initiating projects that are based on the strategic plan, business goals, and critical customer requirements will help prevent time, money, and resources from being wasted on the wrong projects.

The second recommendation for business leaders and project managers who are implementing Six Sigma is to select projects based on opportunities for improvement. Good LSS projects focus on processes that have a lot of waste that needs to be eliminated, long lead, cycle, and wait times that need to be reduced, and issues keeping staff from operating more efficiently and effectively. When projects are based on processes that have opportunities for improvement, this also ensures that the company and the internal and external customers are receiving value from the projects.

The third recommendation for business leaders and project managers who are implementing Six Sigma is to offer Six Sigma training and additional training and expertise outside of Six Sigma. Business leaders should either outsource or develop and offer their own Six Sigma training to make sure that people on projects have expertise. Also, offering project management and change management training, to ensure project managers have expertise in these areas, will enhance the success rates of Six Sigma projects.

The fourth recommendation for business leaders and project managers who are implementing Six Sigma is to get leadership and stakeholder buy-in. Many projects fail because project managers do not get buy-in from leaders or key stakeholders. It is critical to clearly communicate to key stakeholders through status updates, reports, and one-on-one meetings as needed. Project managers should get buy-in from people in the departments who will be impacted by the projects to mitigate resistance and guarantee successful implementation as well.

The fifth recommendation for business leaders and project managers who are implementing Six Sigma is to reassess their Six Sigma framework and tailor it to the needs of the organization. Business leaders who have not implemented Six Sigma should develop the framework to the needs of the company and the people. Those who have implemented Six Sigma may need to reassess their implementation and apply a new Six Sigma framework especially if the current model is not effective.

Recommendations for Further Research

One of the assumptions of this qualitative study was that the college would have enough Six Sigma project managers to interview, and a limitation was that the sample size of participants could be too small. Though I interviewed eight project managers and achieved data saturation, I was not able to recruit 15 participants as planned. Since the current president of the college implemented the IDID framework, that also had a Six Sigma foundation, I had to ensure that I recruited project managers who had experience under the former Six Sigma framework as well. I recommend that future researchers conduct case studies at companies and organizations that are operating Six Sigma implementations. This recommendation will help them recruit enough participants and mitigate the risk of jeopardizing the study by being unable to collect enough data to achieve data saturation.

Another recommendation is for further researchers to conduct a multi-case study. Though I had only eight participants, I collected enough data for this case study, but if I had conducted a multi-case study with different companies and organizations, I would have had a higher probability of interviewing more than 15 participants. I would have

also been able to acquire valuable insights from project managers implementing the Six Sigma methodology in nonmanufacturing environments from various sectors and industries.

Reflections

The doctoral study process was an exciting, learning experience. When I attended my first residency, I did not know how I would get to this point. I was confident that I wanted to conduct a case study on the strategies to implement Six Sigma successfully in nonmanufacturing environments though. Crystallizing the vision for the study throughout the years and having a strong passion for implementing and embedding the LSS methodology as a practitioner helped me remain laser-focused on excelling in my coursework, conducting my case study, and completing the doctoral study.

Being a LSS practitioner in my professional career for 14 years, I know my deep experience and expertise were a personal bias that I had to recognize and address in this case study. Because of this personal bias, I intentionally focused on open-ended interview questions without offering any advice and ideas to the participants. I wanted to guarantee that the data I received from them were raw data, and I was incredibly careful asking follow-up questions because I wanted to ensure that I did not allow my bias to become an issue. After completing the case study and doctoral study, I achieved the goal of not allowing my personal bias, experience, and expertise to be a hindrance to the participants or this case study.

Conclusion

In the qualitative case study, I presented the strategies to enhance the success of Six Sigma process improvement projects in nonmanufacturing environments. Based on the strategies, tools, and techniques that the participants shared, Six Sigma is a methodology that will improve processes, reduce costs, and increase customer satisfaction and profitability if implemented effectively. To implement Six Sigma effectively, business leaders must select the right projects, and identify and train the right project managers who have the expertise and the passion to help people apply the Six Sigma methodology and tools.

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Appendix A: Collaborative Institutional Training Initiative Certificate of Completion

Appendix B: Interview Questions

1. What strategies do you use to select the right nonmanufacturing Six Sigma projects?

2. What strategies do you use to select the appropriate project team members?

3. What strategies do you use to train project team members and key stakeholders before beginning Six Sigma projects?

4. What strategies do you use to overcome Six Sigma roadblocks like resistance from employees, lack of leadership buy-in, and others?

5. What strategies do you use to improve nonmanufacturing business processes and services through Six Sigma projects?

6. What strategies do you use to enhance the success rates of Six Sigma projects?

7. What strategies do you use to sustain nonmanufacturing Six Sigma projects' implementation?

8. How do you assess the success of your strategies for improving the success rates of Six Sigma projects?

9. What other information are you willing to share that I did not ask you regarding the strategies to improve nonmanufacturing environments?

Appendix C: Interview Protocol

Table C1

Protocol for Initial Interview

What I will do	What I will say (script)
Introduce the interview and set the stage.	Script: Thank you for agreeing to participate in this case study to learn the strategies that Six Sigma project managers use to enhance Six Sigma projects' success in nonmanufacturing environments. Here is a copy of your informed consent form. Do you have any questions or concerns before we begin?
Watch for nonverbal cues. Paraphrase as needed. Ask follow-up probing questions to elicit more in-depth responses	1. Question: What strategies do you use to select the right nonmanufacturing Six Sigma projects? 2. Question: What strategies do you use to select the appropriate project team members? 3. Question: What strategies do you use to train project team members and key stakeholders before beginning Six Sigma projects? 4. Question: What strategies do you use to overcome Six Sigma roadblocks like resistance from employees, lack of leadership buy-in, and others? 5. Question: What strategies do you use to improve nonmanufacturing business processes and services through Six Sigma projects? 6. Question: What strategies do you use to enhance the success rates of Six Sigma projects? 7. Question: What strategies do you use to sustain nonmanufacturing Six Sigma projects' implementation? 8. Question: How do you assess the success of your strategies for improving the success rates of Six Sigma projects? 9. Question: What other information are you willing to share that I did not ask you

What I will do	What I will say (script)
	regarding the strategies to improve nonmanufacturing environments?
Wrap up the interview by thanking the participant.	Script: Thank you again for participating in this case study. I appreciate the time you devoted to helping me obtain the strategies to enhance Six Sigma projects' success in nonmanufacturing environments.
Schedule follow-up member checking interview.	Script: I would like to schedule a follow-up member checking interview with you, so you can review the interview transcript with my interpretations of your answers and ensure they are accurate.

Table C2

Protocol for Follow–up Member Checking Interview

What I will do	What I will say (script)
Introduce follow-up interview and set the stage	Script: Thank you for agreeing to a follow-up member checking interview. The goal is for you to review the interview transcript with my interpretations of your answers and ensure they are accurate.
Share a copy of the succinct synthesis for each individual question.	Script: Here is the transcript with my interpretations of your answers to the interview questions. Each question has a succinct synthesis.
Bring in probing questions related to other information that you may have found—note the information must be related so that you are probing and adhering to the Institutional Review Board approval.	1. Question: What strategies do you use to select the right nonmanufacturing six sigma projects? Add a succinct synthesis of the interpretation. 2. Question: What strategies do you use to select the appropriate project team members? 3. Question: What strategies do you use to train project team members and key stakeholders before beginning six sigma projects? Add a succinct synthesis of the interpretation. 4. Question: What strategies do you use to overcome six sigma roadblocks like resistance from employees, lack of leadership buy-in, and others? Add a succinct synthesis of the interpretation.
Walk through each question, read the interpretation, and ask the following questions: "Did I miss anything?" and "What would you like to add?"	5. Question: What strategies do you use to improve nonmanufacturing business processes and services through six sigma projects? Add a succinct synthesis of the interpretation. 6. Question: What strategies do you use to enhance the success rates of six sigma projects? Add a succinct synthesis of the interpretation. 7. Question: What strategies do you use to sustain nonmanufacturing six sigma projects' implementation? Add a succinct synthesis of the interpretation. 8. Question: How do you assess the success of your strategies for improving the success rates of six sigma projects? Add a succinct synthesis of the interpretation. 9. Question: What other information are you willing to share that I did not ask you regarding the strategies to improve nonmanufacturing environments? Add a succinct synthesis of the interpretation.