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Strategies for Catalyzing Supply Chain Innovation in Midsized Manufacturing Firms

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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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Abstract

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MBA, Davenport University, 2002

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Doctoral Study Submitted in Partial Fulfillment

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Abstract

Supply chain inflexibility results in reduced efficiency and profitability. Without supply chain flexibility, supply chain managers in manufacturing firms risk the loss of competitive advantage due to reduced efficiency and profitability. Grounded in business process engineering conceptual framework, the purpose of this qualitative multiple case study was to explore strategies supply chain leaders in manufacturing organizations use to achieve supply chain flexibility. The participants were five supply chain leaders in the manufacturing industry in the midwestern United States and successfully implemented innovative solutions to achieve supply chain flexibility. Data were collected using semistructured interviews and a review of company documents and reports related to supply chain flexibility. Using Yin's five-step thematic analysis, five themes were identified: use of technology, financial considerations, cross-functional collaboration, change management, and improving the customer experience. A key recommendation is for supply chain managers to engage employees and stakeholders in implementing innovations to achieve supply chain flexibility. The implications for positive social change include the potential to reduce the organization's carbon footprint and increase its product quality, resulting in less waste and pollution in the communities and regions where the manufacturers operate.

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Dedication

Completing my doctoral journey would not have been possible without my family and friends' support and encouragement. Through their continuous support, I was able to find strength and perseverance to complete this dissertation.

I would like to dedicate this dissertation to my immediate family, especially my children, Morgan and Garrin. Your constant understanding of the hours that I needed to set aside to complete this dissertation and my doctoral coursework helped fuel my success more than you will ever know. Thank you, and I love you more than words can express.

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Table of Contents

List of Tables

Section 1: Foundation of the Study

Supply chain performance is crucial to the success of an organization. When supply chains are inflexible, it can limit supply chain performance, which can impact competitiveness and profitability (Matthew & Othman, 2017; Roh et al., 2014). Supply chain flexibility is essential in manufacturing organizations, and manufacturing supply chain leaders can improve organizational supply chain flexibility by implementing innovative solutions (Huang & Yang, 2014). This doctoral study was focused on supply chain innovation that improves supply chain flexibility and improves performance in manufacturing firms. The results of this study could aid supply chain leaders in manufacturing firms in developing innovative strategies that would improve supply chain performance.

Background of the Problem

Supply chains are increasing in complexity due to technological evolution, globalization, and competition (Ehm et al., 2011). For supply chain leaders in manufacturing to improve their supply chain flexibility, they must find ways to innovate supply chain processes (Forslund & Jonsson, 2010). Forslund and Jonsson (2010) defined supply chain processes as activities in the supply chain that determine metrics or targets, analyze and measure said procedures, and decide which areas to focus on for improvement. Supply chain leaders that fail to look for opportunities to innovate supply chains run the risk of negatively impacting their organizations (von der Gracht & Stillings, 2013). Innovation is not limited to technology enhancements or improvements alone but also encompasses looking for opportunities to optimize existing methodologies.

Supply chain leaders in manufacturing firms were critical to this study because they have experience in implementing innovative strategies that improve supply chains and organizational competitiveness. Supply chain leaders are accountable for identifying opportunities to improve supply chain efficiencies through innovation (Goksoy et al., 2012), and their decisions can influence the entire organization's success. Supply chain managers are responsible for understanding their organization's supply chain and what processes can be optimized to improve performance. Supply chain managers must recognize that applying innovative strategies to improve supply chain performance will enhance organizational performance (Huang & Yang, 2014).

Problem Statement

Manufacturing firms that do not have flexible supply chains achieve limited efficiency and long-term profitability (Roh et al., 2014). Because 60% of the cost of manufactured products consists of purchased inputs, supply chain inflexibility can adversely impact the competitive ability of a manufacturer (Executive Office of the President & U.S. Department of Commerce, 2015). The general business problem was the failure to implement innovative supply chain strategies may limit supply chain flexibility, increasing the probability of organizational failure. The specific business problem was that some organizational supply chain leaders within the manufacturing sector lack innovative strategies that improve supply chain flexibility.

Purpose Statement

The purpose of this qualitative, multiple case study was to explore the innovative supply chain strategies that supply chain leaders in manufacturing organizations use to

achieve supply chain flexibility. The population consisted of five supply chain leaders in the midwestern U.S. manufacturing industry who had implemented innovative solutions. I selected these organizations because they have successfully implemented innovative strategies to improve their supply chain functions' efficiency and profitability. These more efficient supply chain processes could result in fewer shipment delays, a more quality designed and assembled product, and a reduction of returns and recalls, benefitting customers. By improving the product quality and reducing recalls, society may benefit from not using defective products that may compromise their safety and well-being. Organizations' sustainability can also benefit through reduced fossil fuel consumption and fewer carbon emissions.

Nature of the Study

There are three research methods to choose from: qualitative, quantitative, and mixed. Determining which method to use for this study was predicated on determining what innovation solution strategies supply chain leaders in manufacturing use to improve efficiency and profitability in their organization and which research method would best support that (see Yin, 2017). I chose a qualitative methodology because this study included interviews with logistics leaders in manufacturing organizations, so I could collect information via open-ended questions. Qualitative research is used to explore trends and motivations to understand what drives behavior (Bailey, 2014). Often qualitative researchers seek to identify those trends through interviews to gain a broader understanding and determine the driving forces behind those trends (Yin, 2017). In contrast, the focus for quantitative research is on data, statistics, or quantifying variables

(Yin, 2017), and this methodology is often used in the natural sciences (Allwood, 2011). In quantitative analysis, researchers use close-ended questions that need to fit into predetermined categories to test their hypotheses (Yilmaz, 2013). Examine innovative supply chain strategies within the manufacturing industry did not require testing ideas; therefore, a quantitative methodology was not appropriate for my study. A mixed-methods research methodology is a combination of qualitative and quantitative approaches and is used to address the limitations of those research methods (Caruth, 2013). While it is more encompassing, it is also more complex and used for research where one research methodology is insufficient (Caruth, 2013). Because mixed-methods research includes both quantitative and qualitative elements (Yin, 2017), this method was not appropriate for the current study.

I considered five qualitative research designs for this study: (a) case studies, (b) grounded theories, (c) narrative research, (d) participatory action research, and (e) phenomenological (see Bernard, 2013). I narrowed down the choices to two different qualitative research designs for possible use in this study of innovative business logistics: (a) a single case study or (b) a multiple case study. A single case study can involve testing against an existing theory (Yin, 2017). I did not select a single case study design because I did not test against existing theories; instead, I tried to identify successful theories. A multiple case study is used to compare similar results or findings to each other (Yin, 2017). This design was appropriate because I compared five organizations and their respective best practices to each other.

Research Question

What innovative supply chain strategies do manufacturing sector supply chain leaders use to achieve supply chain flexibility?

Interview Questions

1. What innovative supply chain strategies have you implemented?
2. What were some of the challenges you experienced when implementing innovative supply chain strategies?
3. What organizational metrics did you evaluate to determine if supply chain innovation would positively impact your organization?
4. What were the benefits the organization experienced after implementing innovation within the supply chain functions?
5. How have you promoted successful supply chain innovation?
6. What additional information would you like to add concerning innovative supply chain strategies?

Conceptual Framework

The conceptual framework that supported this study was business process reengineering (BPR), also known as business process change. BPR was first developed by Hammer and Champy in 1993 around the idea that redesigning processes can improve organizational performance (Jurisch et al., 2013). Organizational leaders achieve improvement through cost reduction, improved performance, and quality improvement (Hammer & Champy, 2006; Sethi & King, 1998). I chose BPR as the conceptual framework because BPR focuses on technology and process improvement, which are two

distinct areas that can drive innovative change within organizations. As detailed by Davenport and Short (1990), the five steps in process redesign further support BPR as an appropriate conceptual framework to focus on a redesign, determine key process improvements, or develop the technological solutions that will drive gains in supply chain performance. When organizational leaders evaluate opportunities to innovate supply chains, they assess what technologies to implement and what changes improve organizational efficiencies. BPR is a tool that allows organizational leaders to evaluate changes through a different lens that will aid in driving innovative change (Goksoy et al., 2012).

Operational Definitions

Many of the supply chain terms used in this study may not be familiar to the audience. The most frequently used and relevant phrases are listed below to provide additional context.

Blockchain technology: A shared database or ledger system that can be shared on different permission levels (public or private), and as transactions occur, the information is added to the blockchain and is visible according to the permission or approval levels (Saberi et al., 2019).

BPR: Also known as business process change; a methodology, process, or tool that is leveraged to drive changes within organizations (Kruger, 2017).

Enterprise resource planning (ERP) system: This is a suite of software applications that an organization leverages to automate electronic data resources (Forslund & Jonsson, 2010).

Industrial manufacturing firms: Firms that manufacture components or goods used in other industries or by other organizations (Levinson, 2018).

Industry 4.0: Also known as smart manufacturing; industrial technologies that organizational leaders use to improve industrial processes that enhance flexibility and efficiency (Machado et al., 2020).

Internet of Things (IoT): Smart and connected products that connect an organization's supply chain, improving its agility and enhancing organizational supply chain processes (Aryal et al., 2020; Ben-Daya et al., 2019; Bento & Tontini, 2019).

Logistics innovation: Any process or service, regardless of complexity, that is innovative, new, or helpful to an organization's logistical processes (Flint et al., 2005).

Reverse logistics or returns (returns management): A process in the supply chain where goods or products are returned to an organization (Huang & Yang, 2014; Lambert & Enz, 2017). These goods or products may consist of excess products or materials, customer merchandise returns, used goods, recalled products, or items that are intended to be recycled.

Supply chain innovation: Applying a change, regardless if it is subtle or radical, to a supply chain network, process, or technology. These changes are intended to enhance existing processes and create value for the organization (Munksgaard et al., 2014).

Warehouse management system (WMS): A specific module in an ERP system that is dedicated to warehouse operations including product and information flows and assigned employee tasks and allows those in a supervisory capacity to monitor warehouse operations (Baruffaldi et al., 2019).

Assumptions, Limitations, and Delimitations

In this study, I examined industrial manufacturing organizations leveraging innovative supply chain processes or technologies. The participants were manufacturing organizational leaders in the midwestern United States who manage their organization's supply chains. Researchers need to ensure that the work they produce considers the potential assumptions, limitations, and delimitations of the study. The following assumptions, limitations, and delimitations allowed me to adjust for any deficiencies that they may have created in this study.

Assumptions

Assumptions are areas of the study that researchers expect to be valid and proven (Simon & Goes, 2013). I made several assumptions in this study, with the first being that the supply chain leaders that I interviewed were knowledgeable in supply chain innovation. Another assumption was that the interviewees were honest in their responses. I also assumed that the information collected would support the literature. It was assumed that the participants would be a good representation of supply chain leaders and that the participating organizations would reflect manufacturing organizations. My last assumption was that the information and research would benefit manufacturing organizations and supply chain professionals and support positive change in supply chain innovation.

Limitations

Researchers need to understand that limitations are beyond their control and should be considered a potential weakness (Marshall & Rossman, 2016). A limitation of

this study was that the midwestern manufacturing organizations chosen may not reflect all manufacturing organizations. A second limitation was that not all manufacturing supply chain executives have had an opportunity to implement an innovative solution. The last limitation was that the supply chain innovative solutions provided by the participants may not be viable for all manufacturing firms.

Delimitations

Delimitations are boundaries that the researcher sets to guide their research (Simon & Goes, 2013). The boundaries may consist of (a) the focus of the questions asked, (b) the innovative logistics solution objectives, (c) and the theories used to support the study. One delimitation was that the selected interviewees were supply chain leaders within organizations. There may have been positions other than those involved within supply chains that could have contributed to the study. Another delimitation was using midsized industrial manufacturing firms in the Midwest instead of a more significant financial and geographic scope.

Significance of the Study

This study's findings may contribute to the body of knowledge regarding innovative supply chains within manufacturing organizations. The results may provide insights to enable leaders to leverage their supply chains to improve efficiencies, increase profitability, and differentiate their organizations from competitors. This research may contribute to positive social change by improving the end-customer experience by reducing product availability delays and costs, diminishing the frequency of returned and recalled products, and improving product quality, which can benefit society's health and

safety. The community may further benefit the results of this study through the creation of additional skilled supply chain positions within manufacturing organizations.

A Review of the Professional and Academic Literature

The purpose of this qualitative, multiple case study was to explore the innovative supply chain strategies that supply chain leaders in manufacturing organizations use to achieve supply chain flexibility. To locate literature for this review, I searched multiple databases using broad-based and focused search phrases to identify scholarly journal articles, books, and other sources to gather information on the research topic. Through the Walden University Library and Google Scholar, I searched the ABI/INFORM Collection, Business Source Complete, Emerald Insight, IEEE Xplore Digital Library, ProQuest Central, and SAGE Journals databases to find articles relevant to my area of research. After reviewing more than 200 resources, I included 107 references in this literature review, of which 102 are peer reviewed. The percentage of references that are peer reviewed is 95%. Seventy-two of the references were published between 2017–2021, and 35 were published before 2016. The percentage of peer-reviewed articles published within 5 years of my graduation date is 67%.

The search terms used were *supply chain management, supply chain innovation, supply chain automation, supply chain mitigation, innovation and competitiveness, business process reengineering, manufacturing, warehousing, warehouse optimization, enterprise resource planning software (ERP), Six Sigma, system applications, and products (SAP), Warehouse Management Systems (WMS), warehouse automation, industry 4.0, Internet of Things (IoT), data analytics,* and *blockchain technology.*

I used the articles reviewed to explore opportunities where supply chain executives may use innovation to enhance the supply chain to improve overall organizational performance. Organizational performance may include increased efficiency, improved competitiveness, better profit margins, and enhanced organization longevity. The information in the scholarly resources provides information that supply chain leaders can use to improve their supply chain's overall performance and positively impact the organizations they support.

BPR

BPR is a tool used by organizations and management to examine, identify, and modify existing processes that impact cost, service, efficiencies, competition, and the overall critical functions that can impact production and quality (Goksoy et al., 2012). Practitioners and scholars have agreed that BPR is an often-used method to bring needed change and improvement to organizations (Goksoy et al., 2012). Application of BPR to existing processes can impact multiple areas of an organization.

BPR has been documented to impact cost reduction, improve performance, and enhance quality (Goksoy et al., 2012; Hammer & Champy, 2006). BPR can also drive flexibility and dependability while making an organization more competitive (Goksoy et al., 2012; Vokurka & Fliedner, 1998). Organizations are in a constant state of flux due to external factors (Jurisch et al., 2013), and to effectively deal with those outside influences, organizations can implement BPR techniques. Organizational transformation is a series of changes to multiple processes throughout an organization that typically involve technology, efficiency improvements, and innovation and applying them in new

ways that enhance or reinvent business processes (Goksoy et al., 2012). Process or design innovation, a series of task analyses and identification, is a precursor to BPR implementation (Bhaskar, 2018; Jurisch et al., 2013; Vokurka & Fliedner, 1998). Reengineering a process impacts multiple functions, affects the function it directly supports, and the additional functions influenced by the process (Goksoy et al., 2012). BPR is an opportunity to evaluate existing processes and identify ways to optimize operations that will improve critical business metrics, like competitiveness, cost containment, and improved performance. Often, the areas to assess are those processes that are outdated and inefficient.

BPR can positively impact worker productivity and efficiency (Kruger, 2017; Sethi & King, 1998; Zhilyaev et al., 2018). BPR is frequently used to replace old and inefficient processes (Bhaskar, 2018; Sethi & King, 1998). Before implementing any BPR initiatives, a thorough analysis of what process or processes could be enhanced should be evaluated beforehand. It is crucial that an understanding of what and who BPR initiatives will impact is understood (Kruger, 2017; Sethi & King, 1998) as well as what area management should target for reengineering (Goksoy et al., 2012; Kruger, 2017). The methodology of what areas organizations should target to reengineer will vary by industry, how frequently the organizations will make changes, the number of functions or departments within the organization, and what metrics to target for improvement (Kruger, 2017; Sethi & King, 1998). Supply chain executives can identify the need to implement improvements by assessing many areas within their organizations, including financial losses, competitive threats, increasing inefficiencies, lack of proactive enhancements, or

internal changes as the organization has evolved or changed priorities integrating innovative solutions or technological enhancements. (Goksoy et al., 2012). Organizational leaders can identify areas of opportunity to target for BPR by taking a critical look at areas of an organization that have changed and what processes may be obsolete. As potential targets, leaders can evaluate functions or processes that cost the organization more than they previously did. Areas to enhance from a technological perspective are additional areas to inspect as a process in the supply chain that can improve supply chain performance.

Supply Chain Management

Supply chain management (SCM) is defined as the consolidation of business processes to include end-users, suppliers, and other stakeholders that bring additional value to customers and the organization (Anca, 2019; Min et al., 2019). SCM has been receiving more attention from academics and practitioners when looking to improve supply chain performance, reduce cost, and improve competitiveness (Li et al., 2006; Min et al., 2019). A challenge for supply chain executives is making decisions involving supply chains quickly (Jugovic et al., 2019). Supply chain influencers can develop strategies that can improve efficiencies and performance and drive sustainability initiatives within an organization (De Soete, 2016; Ince et al., 2013). SCM can help drive competitiveness and business performance in the manufacturing industry but is not often considered (Jafarnejad et al., 2017; Matthew & Othman, 2017). Technology often drives supply chain innovation, and technology can make manufacturing processes more efficient (Baxter et al., 1996). Manufacturing processes that are more efficient due to

using technology can positively impact the environment (Kaur et al., 2018). SCM is comprised of all the varied processes and steps across a supply chain. SCM is not limited to a specific organization but encompasses all the external entities that can interact within an organization, such as suppliers, customers, or other departments or functions (Min et al., 2019). SCM is a complex network of many moving parts, and effectively managing those parts can result in process improvements, efficiencies, and cost savings for an organization's supply chain. Organizational leaders can use SCM to enhance innovative technologies and efficiencies positioned within an organization's supply chain.

Both researchers and practitioners see the value in SCM, its impact on operational performance, and the direct effect on supply chain performance (Jafarnejad et al., 2017; Parast, 2020). Innovative technology can impact organizational and operational performance, which drives manufacturing organizations' flexibility (Panigrahy et al., 2011; Parast, 2020). SCM leaders within organizations should be evaluating opportunities to improve all areas of the supply chain and using technology to analyze data and interpret information is a critical part of the process (Min et al., 2019). SCM is an area of practical and academic application that demonstrates organizational flexibility, process improvement, and evolution of the supply chain are primarily dependent on technology and innovation (Jugovic et al., 2019; Min et al., 2019). SCM and the business processes it impacts are essential to organizations but often disregarded (Zhu et al., 2008); however, if organizational supply chain leaders implement SCM process efficiencies, they will increase firm performance (Ince et al., 2013; Li et al., 2012). Supply chain leaders who thoroughly evaluate opportunities and implement processes can improve their SCM

functions' overall effectiveness. The results from both academic and practical perspectives demonstrate that managing a supply chain efficiently can benefit an organization. By finding opportunities to use innovation and technology to accelerate those efficiencies, organizations will gain more significant results.

Supply Chains and Innovation

Flexibility and innovation can impact an organization in multiple ways. When specifically applied to supply chains, flexibility and innovation can significantly impact an organization (De Martino et al., 2013). Having inflexible supply chains can impact efficiency and long-term profitability (Roh et al., 2014). Research has shown that corporations are always looking at innovation within their supply chains to drive critical business metrics (von der Gracht & Stillings, 2013). Supply chain leaders are continually evaluating and implementing innovative solutions that improve performance in manufacturing firms (Huang & Yang, 2014). Supply chain innovation within companies or industries is something that supply chain leaders believe can be impactful to all stakeholders involved (Munksgaard et al., 2014). Positioning innovative solutions in organizational supply chains can positively impact multiple areas in manufacturing organizations. Innovation can not only improve organizational capabilities but can also improve supply chain resiliency.

When determining what innovation to implement in supply chains, it is vital to assess the needs of the organization's customers (Flint et al., 2005). Customers are an important part of the process because understanding the desired impact on the organization and ensuring that the customers' needs are met will drive the desired

innovation. To be considered an innovative organization, listening to customers is critical (Flint et al., 2005). Organizational excellence and innovation are driven by critically assessing where change is needed, how that change aligns with key business metrics, and how it will be monitored and controlled (Fonseca & Domingues, 2017). Innovation can be different things for different organizations. It may be a new technology installed or the way technology is used, but when a supply chain decision-maker evaluates what process or system to innovate, how customer needs will be impacted is essential. The level of innovation to be implemented will warrant multiple considerations.

Supply chain decision makers need to understand what areas require improvement before evaluating innovation opportunities. The first thing to decide is what areas to target to drive operational improvement, technological enhancement, service improvement, or service-focused initiatives (Flint et al., 2005). Cost reduction in the supply chain is a focus of most organizations and is a driver of positioning innovation (Pettersson & Segerstedt, 2013). Some supply chain leaders will analyze the supply chain costs and make their decisions based on that alone (Pettersson & Segerstedt, 2013), but this may limit the benefits of the innovation positioned as strictly a cost initiative. Innovation is not always a situation where something radical or new is implemented; often, innovation has been previously leveraged in other areas (Flint et al., 2005). Successful innovation cannot happen unless there is an evaluation beforehand and specific areas are targeted for improvement. Organizational leaders need to predetermine what challenges exist and the best solutions to address them.

Organizational Challenges

Organizations can address many challenges by implementing supply chain innovation. Organizational supply chain leadership needs to look at their supply chains as potential value levers to differentiate them from competitors and bring value to their organization (Munksgaard et al., 2014). Not knowing what will change and how organizational decisions will impact those changes are challenges that organizations frequently face (von der Gracht & Stillings, 2013). It is best if organizations are open to the concept of change to be innovative (Busse & Wallenburg. 2014). Organizations are continually challenged by external and internal influences, such as regulatory compliance, customer demands, investors, stakeholders, and the current and future organizational needs (Fonseca & Domingues, 2017). New challenges arise with supply chains evolving continuously, and with change and evolution, opportunities for improvement present themselves. Innovation can help address the challenges organizations face, but supply chain executives must embrace the change that innovation will bring. Preparing for that change and the impact it may have is a critical evaluation point.

Determining the type and level of supply chain innovation available to organizations is challenging. Not only does an organization have to decide what specific innovation or innovations to target, but whether to initiate a sudden or gradual change must also be determined (Munksgaard et al., 2014). An organization must assess the impact of innovation on the workforce and revenue streams (Busse & Wallenburg. 2014). There could be employee training or project implementations that could impact short-

term revenue. However, implementation of supply chain innovation strategies should focus on the long-term benefits, and supply chain leaders should evaluate the long-term plan (von der Gracht & Stillings, 2013) and thoroughly assess both internal and external factors to help finalize that decision (Fonseca & Domingues, 2017). Innovation, how it should be implemented, and the impact on the existing organizational processes and staffing are important considerations. Many areas can be targeted and determining which areas will have the most significant effect is essential. How to improve organizational competitiveness is an area many organizations initially evaluate.

Innovation Driving Competitiveness

Opportunities exist within manufacturing firms to leverage supply chain innovation to impact many areas of their business positively. Competitive advantages can be gained by leveraging innovation (Arlbjørn & Paulraj, 2013). Bellingkrodt and Wallenburg (2015) discussed that innovation efforts could also impact organizational competitiveness. Busse and Wallenburg (2014) explained how to leverage innovation to improve competitiveness when exploring logistics service providers and their focus on driving changes with the organizations they worked with. Innovation and change are adopted by organizations as globalization and competitiveness increase (Goksoy et al., 2012). Innovation can also be a competitive differentiator; therefore, supply chain executives can innovate many areas within a supply chain to enhance an organization's competitive advantage.

Further exploration into innovation and its ability to impact competitiveness demonstrates different areas of opportunity. In organizations in developed economies,

innovation may be the most important catalyst that drives competitiveness (De Martino et al., 2013). Improving processes in a company's supply chain can lead to more competitive scenarios (Munksgaard et al., 2014). Supply chains consist of many different functions, such as sourcing, procurement, logistics, processes, and the information that accompanies these functions to improve innovation. Overhauling the entire supply chain is not always needed and improving specific areas may lead to competitive advantages. Huang and Yang (2014) discussed how reverse logistics can be a competitive advantage by improving an organization's effectiveness and overall efficiency. Organizations need to reinvent and innovate their methodologies constantly to remain competitive (von der Gracht & Stillings, 2013). When looking to identify areas within the supply chain to innovate that impact competitiveness, there are multiple areas that supply chain decision-makers can evaluate. Evaluation and implementation do not need to be restricted to one place; numerous areas can be targeted to enhance success. The areas that should be targeted are those where immediate efficiencies, processes, or costs can be realized.

Innovation in Manufacturing

Manufacturing organizations can benefit from implementing innovative solutions to improve operational performance. Manufacturing organizations may find it easier to enhance actual manufacturing processes as opposed to business processes (Kruger, 2017). Manufacturing is increasingly essential to the United States' economy to such an extent that the government passed the Revitalize American Manufacturing and Innovation Act in 2014. This act is part of a much broader initiative to develop a collection of organizations to drive manufacturing innovation through the Network for Manufacturing

Innovation Program, a part of the Department of Commerce's National Institute of Standards and Technology (Neumann, 2019). While the act is focused on manufacturing advanced technologies, manufacturing benefits from this initiative. According to a Congressional Report, during the years of 2002-2016, manufacturing has declined 10% (Neumann, 2019). As United States manufacturing strives to remain competitive, it is important to realize that manufacturing supply chain innovation can impact efficiencies and additional metrics that will allow manufacturers to increase their competitiveness.

Manufacturing firms can benefit from innovative software solutions such as computer-aided design/computer-aided manufacturing (CAD/CAM), ERP system applications and products, and WMS. Since the 1990s, software has played a significant role in the impact of technological evolution in manufacturing (Burke & Sinclair, 2014). CAD was developed to help facilitate design functionality by making the process more interactive and accelerating production and manufacturing processes. CAM evolved out of necessity to speed up the transition from the design process to the products' actual manufacturing. These integrated and seamless steps have streamlined many production processes (Burke & Sinclair, 2014). CAD/CAM systems have reduced the time it takes to design, test prototypes, and manufacture products (Pardo et al., 2019). Manufacturing innovation can be attained via the implementation of innovative software solutions. These software solutions aid in streamlining and accelerating manufacturing processes, which will improve manufacturing competitiveness. There are multiple software applications organizations can evaluate to drive innovation.

Additional software solutions that manufacturing organizations benefit from include ERP systems, which are integrated software applications that allow organizations to automate electronic data flows (Forslund & Jonsson, 2010). WMS, a module within an ERP system that focuses specifically on warehouse functions and operations (Baruffaldi et al., 2019). Evaluating the benefits of innovative software solutions and how they specifically impact areas of the organization's supply chain will ultimately determine which solution to utilize.

ERP Software (Systems)

Organizational leaders should evaluate implementing an ERP system to innovate their organizational supply chains. An ERP system is several integrated software applications that provide access to information from several workstreams allowing for integration and automation of processes (Forslund & Jonsson, 2010). The potential to integrate functions or departments and their associated data is endless (De Soete, 2016), but supply chains are an area that will significantly benefit as integration provides transparency across the entire supply chain (De Soete, 2016; Kandananond, 2014). The integration of multiple applications allows for the information to be shared in real-time across all functions. This provides information such as inventory specifics, cost, product visibility, and order specifics to be shared with finance, sales, operational excellence, and customer service. This streamlines processes and enables more timely decisions (De Soete, 2016; Zhu et al., 2008). The importance of managing data in an organization's supply chain is a consideration when looking for opportunities to improve performance (Forslund & Jonsson, 2010). Improvement in innovation opportunities would allow

organizations to benefit from logistics enhancements (De Soete, 2016; Forslund & Jonsson, 2010; Ince, Imamoglu et al., 2013). Organizations evaluating ERP systems are looking to enhance supply chain performance or overall business performance (Shatat & Udin, 2012). Manufacturing organizations can often benefit from implementing an ERP system (De Soete, 2016). As supply chain complexities have increased, organizations are looking to innovate internal supply chain processes and integrate and improve supply chain processes with external customers (Forslund & Jonsson, 2010; Kandananond, 2014). When looking at additional benefits that implementing an ERP system can have regarding supply chain implementation, eliminating existing redundant supply chain processes is possible (Zhu et al., 2008). ERP systems integrate multiple applications to streamline data flow and visibility across various functions. This integration allows organizations to attain innovation levels that will enhance supply chain performance by streamlining processes. It is important to evaluate which specific areas of the supply chain will be targeted for enhancement as failure to do so could have negative ramifications.

When considering both internal and external supply chain opportunities that ERP systems can influence within organizations, the first step is to assess the current supply chain and its future. ERP implementations are considerable undertakings, and as many as 60% of implementations fail (Leopoulos et al., 2005). It may take 8 months to see benefits from an ERP implementation (Shatat & Udin, 2012). Implementing an ERP system is a considerable investment for an organization. It needs evaluation and discussion before implementation or failure is a possibility due to not sufficiently

managing change with the organization's employees (Kandananond, 2014). There are many benefits that an organization may see from a successful ERP implementation. The first is increased competitiveness (Ince et al., 2013; Zhu et al., 2008), another is an expedited production process (Zhu et al., 2008), a more efficient supply chain performance (De Soete, 2016; Forslund & Jonsson, 2010; Ince et al., 2013; Kandananond, 2014; Shatat & Udin, 2012), improved relationships with customers and suppliers (De Soete, 2016; Forslund & Jonsson, 2010; Ince et al., 2013; Shatat & Udin, 2012), better internal departmental information sharing (De Soete, 2016; Forslund & Jonsson, 2010; Ince et al., 2013; Shatat & Udin, 2012), and a greener supply chain (De Soete, 2016; Kandananond, 2014). Evaluation of an organization's supply chain's future state is important before the assessment and implementation of an ERP system as the process can take considerable time and resources and the subsequent expense.

It was mentioned previously, but it is important to emphasize that an ERP implementation is a lengthy process. These are large projects that require considerable organizational resources both in the evaluating and implementation phases (Kandananond, 2014; Leopoulos et al., 2005). The diligence in the evaluation process is important as schedule, and budget overruns are frequent (Leopoulos et al., 2005), and having a capable management team to evaluate the specific needs regarding an ERP implementation is critical to its success (Forslund & Jonsson, 2010; Ince et al.; Kandananond, 2014). Ensuring that the ERP implementation successfully depends on the organization's employees (Forslund & Jonsson, 2010; Ince et al.). Communication of the ERP system deployment, in all deployment phases, is also critical (Kandananond, 2014)

and from a post implementation perspective tracking the successes of the deployment to ensure the desired results were attained and that adjustments made will ensure long-term success (Kandananond, 2014). While ERP system deployments are a considerable undertaking, the rewards are significant (Shatat & Udin, 2012). ERP implementations require substantial evaluation and preparation to determine the resources needed before, during, and after the project. The resources dedicated to the project will determine how much improvement will be realized in the organization's supply chain. Once an ERP system has been implemented, there will be opportunities to assess modifications or enhancements further to improve business processes further.

WMS

As supply chains have evolved and the demand for warehouses and distribution centers (DCs) has increased, technology needs to manage those warehouses has become increasingly important (Mao et al., 2018). To assist with managing these warehouse processes, organizations can now leverage WMS, a module of an ERP system dedicated to warehouse operations, including goods and information flows, employee tasks, and warehouse operations monitoring. (Baruffaldi et al., 2019). Warehouses and DCs are used to store goods and products (inventory). As warehouses and DCs have been growing, the added number of products being warehoused needing to be tracked, managed, and stored has created even more challenges (Tejesh & Neeraja, 2018). Warehouses have continued to increase in size and complexity, requiring additional systems to monitor and provide inventory visibility and the processes that manage that

inventory. A WMS will help manage the functions and processes that impact efficiency and profitability.

There are many different processes in warehouse or distribution centers that a WMS can assist in managing, including operational flows and monitoring of dispatch, warehouse optimization, inventory visibility, and goods management (receiving, storing, retrieving, and shipping). When looking at these processes collectively, there are commonalities, they save time and improve efficiency (Baruffaldi et al., 2019; Mao et al., 2018), they enhance internal service levels, which positively impact customer relations (Baruffaldi et al., 2019; Mao et al., 2018, Zunic et al., 2018) and the analytics provided allow for detailed visibility into all of the processes which means organizations can make decisions more quickly and frequently to drive even more significant results (Baruffaldi et al., 2019; Zunic et al., 2018a). A WMS will assist supply chain executives with resource management, streamlining processes, product accountability, and visibility and optimizing workflows. Supply chain executives need to evaluate processes within a warehouse associated with inventory movement.

When evaluating the different areas that a WMS can impact, we will initially focus on the benefits of managing operational flows and employee dispatch. The WMS can help coordinate the physical goods and the related information in warehouses (Ramaa et al., 2012). Implementing a WMS to improve the flow of physical goods and assist with employee dispatch is justification enough to invest in this warehouse system (Baruffaldi et al., 2019). The optimization does require some data management input and identification implementation on the front end, such as barcoding or tagging of the

inventory or storage locations within the warehouse (Tejesh & Neeraja, 2018). Additional process analysis of the current inventory product workflows such as inventory placement, flow (inbound and outbound), optimal placement and type of racking, picking, and packing, and transporting, and visibility of the movement of the products (Ramaa et al., 2012; Zunic et al., 2018). It is recommended that observations of the processes or value chain mapping be completed to accurately determine where improvements should be targeted in the warehouse operations (Ramaa et al., 2012). If one or more of these flows or processes are implemented, it can drive savings in the organization (Chiang et al., 2011; Ramaa et al., 2012; Zunic et al., 2018b). Improving employee dispatch, much like operational flows, will improve efficiency and can eliminate employee redundancy (Ramaa et al., 2012). The improvements in employee efficiency are realized from the improved warehouse workflows. Workflow optimization is accomplished by reducing employee hours worked by making them more efficient; an example of this is product grouping within the warehouse; if frequently picked products are put in optimal locations, it will improve the routes the employees travel, improving their efficiency by reducing the time it takes to place, pick, or move products (Chiang et al., 2011). A WMS optimizes and provides additional visibility into all the workflows and associated employee dispatch, allowing supply chain managers to increase productivity, improve warehouse efficiency, and reduce expense. This visibility into inventory flows and the supporting processes are critical areas to evaluate when looking at optimization opportunities.

Supply chain executives should prioritize the tasks focused on the product and inventory placement. Multiple steps impact cost and productivity that a WMS can assist

with optimizing. Many organizations do not monitor their existing warehouse processes (Zhu et al., 2008), and as emphasized earlier, understanding the processes is essential to increase efficiency and profitability (Baruffaldi et al., 2019). Specific areas that can be evaluated for targeted improvement on the supply chain's inbound side are receiving, putting away inventory, and storing. Inbound operations consist of the organization receiving the finished product or raw materials from suppliers or distribution centers. The supply chain's outbound side is picking, packing, sorting, and shipping. Outbound operations consist of the movement of finished goods or products to wholesalers, distributors, or directly to customers. With both the inbound and outbound processes, visibility is also important (Chiang et al., 2011). Understanding the specific areas allow for a greater understanding of where efforts can be focused is a priority, as an example, picking orders can be a large part of operating expenses in a manual warehouse (Chiang et al., 2011) and without identifying that as a deficient area, it would not be able to be addressed. Organizational leaders are adopting innovative strategies and implementing WMS technologies to identify and improve warehouse deficiencies (Ramaa et al., 2012). By replicating this process for all the inbound and outbound processes, supply chain leaders to improve margins and efficiency (Zunic et al., 2018a). A WMS can help supply chain executives identify areas in a warehouse specific to inbound and outbound operations and inventory movement optimized to improve cost mitigation. The inbound and outbound process enhancements could also improve the consumer experience.

A WMS implementation can also improve service level improvements and create competitive advantages in an organization's supply chain (Ince et al., 2013; Li et al.,

2006; Ramaa et al., 2012; Shatat & Udin, 2012). Service levels can be impacted in different areas, ultimately ensuring that the customer's expectations are improved in some aspect (Ince et al., 2013). When looking at managing customer expectations, several areas can be impacted, and the first is order accuracy (Ramaa et al., 2012). Order accuracy can be improved by warehouse process changes while optimizing employee efficiency, and when warehouse employees' tasks are optimized and prioritized, the quality of their work improves. (Min, 2006). During the picking and packing steps, order accuracy is important as the items are being fulfilled for the consumer. Any discrepancy in order size, color, or quantity could result in a poor customer experience and lost sales (Shin et al., 2015). Supply chain leaders should strive for excellent service while optimizing the resources or staffing required to accomplish the service levels (Zunic et al., 2018b). Customer satisfaction can be negatively impacted if an item is not available for an order due to it being out of stock, impacting future sales (Shin et al., 2015). Managing inventory levels within a warehouse is vital as it affects operational and financial performance (Shin et al., 2015). Tracking products in warehouses can be challenging given there are so many steps in the inventory management process (Min, 2006). Implementing a WMS can help manage staffing, manage inventory levels, product turn, dealing with obsolescence and optimal placement of the product (Baruffaldi et al., 2019; Min, 2006). The impact that a WMS implementation can have on improving the customer experience cannot be overlooked. The visibility that a WMS provides into inventory and the availability of the products for consumer fulfillment and the associated steps such as order accuracy,

preventing stock-outs, and providing visibility will satisfy customer expectations and improve an organization's competitive position.

A WMS can gather and provides a means for supply chain managers to have greater visibility into warehouse processes through the data it can collects. Managing data and information is critical to understanding the areas where operational efficiencies can be optimized (Chiang et al., 2011). A WMS (ERP) can assist with the data collection that is critical to developing the processes that ultimately drive warehouse efficiency (Shin et al., 2015). Information is leveraged not only in managing the day-to-day activities such as inventory levels, product placement within the warehouse, the ultimate storage location of inventory as well as historical information to determine the frequency of product cycle, which will aid in employee dispatch and the most efficient use of existing warehouse space (Chiang et al., 2011). Data management can also help meet customer's service expectations (Min, 2006). Having a viable data repository also allows the data to be shared among multiple departments (Baruffaldi et al., 2019). The data can also be leveraged to provide performance metrics, which allow for the constant monitoring of warehouse processes to ensure that all areas are running at peak performance (Zunic, 2018b). The data that a WMS provides can provide insights into processes that can be improved within a warehouse and include information that other functions can use to increase efficiency.

Warehouse integration technology is another area used to drive efficiency (Mao et al., 2018). Having a WMS and taking advantage of the warehouse processes are beneficial, but more can be accomplished by integrating other functions or department's

technologies (Ince et al., 2013). How old the ERP (WMS) system is also an important consideration as older systems may not include external integration sources (Forslund & Jonsson, 2010). Including the current system's limitations is an area where substantial gains can be accomplished. When looking at which technologies can be integrated, auto-ID, Radio Frequency Identification (RFID), or other data systems or organization data collection services are areas where supply chain leaders should leverage (Baruffaldi et al., 2019; Mao et al., 2018). Shatat & Udin (2012) stated that integration of an ERP system could optimize the flow of information between departments within a company and help share information with suppliers, customers, and other external parties that may require information or visibility to areas of the supply chain. The integration of additional technologies can further enhance the benefits of a WMS.

When determining what integration to consider, there are two main areas, those that impact an organization's internal processes and those that affect an organization's external processes (Shatat & Udin, 2012). Internal integration could include inventory reconciliation as orders occur, regardless if the inventory is on-site or in remote locations, tying those orders back to accounting systems and proper departments or cost codes to allow timely billing and that the appropriate accounting entries are made, visibility of who is making the purchases or receiving the order to allow for follow up or visibility and the pushing out of the order information to the external source while maintaining the information in the event the organization wants future access. Supply chain leaders can use the WMS to determine how inventory levels have fluctuated over time, which can be insightful when choosing how well the warehousing processes have worked (Baruffaldi

et al., 2019). External integration could include communication of inventory levels, shipments, or billing statements. This could be valuable given customers use just-in-time ordering in their dealership or distribution models and planning order arrival, fulfillment, or installation and can be important for an organization to perform optimally (Shin et al., 2015). Regardless of whether the process optimization is internal or external, ensuring that the processes are automated to reduce any manual touchpoints will allow businesses to get the most out of their integration (Shatat & Udin, 2012). Integration of internal processes, or those specific to data within the organization and external processes, or those involving information sharing with those outside of the organization are data sources that a WMS can provide that can drive overall supply chain performance.

Supply Chain Automation

Supply chains can benefit from manual process automation, especially given how much supply chains are increasing in complexity. This growth is being accelerated by multiple factors, including global commerce and trade, the advent of more readily available technologies, increased consumer demand to receive the products sooner, and visibility of the product's location within the supply chain (Ehm et al., 2011; Partida, 2018). The need to use technological advancements such as automation of manual processes or integrating information flows to simplify these complex processes increases (Ehm et al., 2011). Organizations would benefit from supply chain quality improvements (Jugovic et al., 2019). These supply chain improvements can originate in different areas, including processes that aid in the physical movement of goods, the movement of information between companies, or communication with customers, all of which would

drive greater efficiency and effectiveness within organizational supply chains (Viswanadham, 2000).

Automation to streamline processes is not new; it has been a constant state of evolution for many manufacturing organizations since the 1900s. Henry Ford's assembly plant automation is an example of streamlining a process (Viswanadham, 2000). In the past, automation in the supply chain has been focused on the procurement and transport of raw materials to the manufacturer, warehousing enhancements, and end-consumer delivery (Partida, 2018; Viswanadham, 2000). In current supply chains, the original methodologies are still significant focus areas, but there is a need to include additional areas of concentration as businesses have evolved. E-commerce has caused a shift in product flow, which has created the need for additional transportation modes, reverse logistics, and visibility of the shipped goods to the end consumer's homes. This visibility may be from distribution centers, fulfillment locations, or directly from the manufacturer, and integration to billing and finance systems and warehouses to know inventory levels are critical (Ehm et al., 2011; Partida, 2018; Viswanadham, 2000). Evaluation of automation of supply chain processes needs to include existing steps and those that may be developing, such as steps created by the e-commerce evolution, to drive efficient supply chain process evolution.

When automating supply chain processes, the quality of execution and service quality is critical, especially when managing multiple distribution modes (Jugovic et al., 2019). Quality is also essential when focusing on automating the sales order process. When looking at quality, consumers are looking for a seamless, error-free process that

allows for quicker receipt of their purchases. Automating the order and payment processes add to the experience's quality, reduces errors, and positively impacts other critical metrics (Partida, 2018). Supply chain automation affects other areas of quality that are beneficial to the end consumer, specifically those that can enhance customer loyalty and satisfaction while simultaneously driving down costs and improving profitability (Jugovic et al., 2019). Quality of process, especially when related to what a customer experiences during the ordering process and the order's information, are potential automation steps.

Competitiveness is also positively impacted by automating supply chain processes. Automation can be achieved by installing an ERP system or implementing quality improvement processes such as Six Sigma. ERP system implementation can help organizations improve their competitiveness (Ince et al., 2013; Shatat & Udin, 2012; Zhu et al., 2008). ERP systems streamline and automate supply chain processes by integrating software applications that allow multiple functions to access and share data allowing for faster customer order fulfillment and enhanced product or order visibility. Having visibility into product inventory and end consumer visibility reduces supply chain disruptions (De Soete, 2016). If the end consumer is satisfied with their purchase, it gives an organization a competitive advantage (Ehm et al., 2011; Jugovic et al., 2019; Partida, 2018; Viswanadham, 2000). Six Sigma, quality improvement methods, can help organizations be more competitive (Andersson & Pardillo-Baez, 2020; Cesarotti, 2019; Juliani & de Oliveira, 2020; Mehmood & Afzal, 2019). Six Sigma improvements can guide the organizational leader's supply chain decision-making to enhance the customer

experience by identifying and implementing metrics that focus on improving customer satisfaction (Ben Romdhane et al., 2017). If organizational supply chain leaders can identify processes in production that reduce lead time, enhance the flow of products and materials, reduce defects, improve information flows, and assist with the improvement of areas that benefit the flow of capital, customers will benefit (Jordan et al., 2019; Mehmood & Afzal, 2019). Competitiveness is important in the global economy that organizations are dealing with today as competition can be from anywhere in the world. It also allows an organization to compete anywhere in the world. This can be beneficial when assessing the impact of global economic fluctuations and the ability to sell to countries experiencing economic growth instead of trying to sell to countries experiencing economic downturns (Ehm et al., 2011). Having automated supply chain processes that are easy to replicate and integrate allows for quick and efficient global supply chain movements (Viswanadham, 2000). Supply chain automation can also increase the competitiveness of an organization. When looking at the importance of worldwide trade and commerce, the ability to integrate and automate processes provides a means to compete with other companies around the globe.

Warehouse and Warehouse Optimization

When looking at an organization's supply chain, warehouses are among the largest and most important components. Warehouses are an integral part of the supply chain (Bao et al., 2019; Caridade et al., 2017; Dobrilovic et al., 2012). Warehouses are one of the more considerable expenses within a supply chain (Bao et al., 2019; Caridade et al., 2017), and organizations are continually evaluating for opportunities to reduce

operating costs and improve warehouse efficiencies (Dobrilovic et al., 2012; Mirabelli et al., 2013; Zeng et al., 2018). Given the rise of electronic and global commerce, organizations maintain many items to offer to their customers, leading to warehouse inefficiencies and congestion (Tanaka et al., 2018; Yafei et al., 2018). Warehouse congestion, inefficiencies, and the subsequent service issues being created are areas that organizations need to evaluate and address with more efficient warehouse processes to improve performance (Rupasighe & Dissanayake, 2018). Performance or cost reduction can be evaluated in several ways, including leveraging a WMS to track inventory levels or determine how long product has been in inventory. A WMS can also assist with location optimization and help design optimal storage locations or the most efficient travel path to retrieve products (Bao et al., 2019). Finding opportunities to improve warehouse efficiencies is an area that can improve overall supply chain performance as warehouses are one of the most significant expenses. One of the reasons warehouses are one of the more considerable costs is the inventory levels that a warehouse must maintain.

Given the increased inventory levels that organizations are being challenged with, which limits warehouse space availability, warehouse optimization and efficiency can be improved by evaluating and implementing just-in-time (JIT) or economic order quantity (EOQ) inventory models. Ensuring that an organization has appropriate inventory levels can impact a firm's performance (Lim & Tan, 2018; Shin et al., 2015). JIT is an inventory model where an organization takes goods just before needed (Lim & Tan, 2018). JIT keeps inventory levels at an optimum, keeping space utilization low and reducing costs

(Lyu et al., 2020). Organizations that practice JIT inventory modeling improve operational and financial performance (Lim & Tan, 2018; Shin et al., 2015). EOQ is an inventory model where historical information is analyzed and used to calculate optimal inventory levels (Hongguang et al., 2012; Kumar, 2016). EOQ is one of the oldest inventory models used by organizations since the early 1900s (Kumar, 2016). EOQ requires that the organization know the demand levels and inventory at defined periods accounting for projected demand (Rabta, 2020). Organizations that practice EOQ benefit from optimal inventory levels and cost reductions (Fithri et al., 2019; Hongguang et al., 2012; Kumar, 2016). Finding opportunities to optimize inventory levels using EOQ or JIT inventory methodologies can reduce costs by improving space utilization and eliminating the storage product that does not turn over quickly. Regardless of which inventory modeling system organizations use to improve warehouse performance, organizational leaders must consider a method to assist with inventory optimization to reduce costs and enhance warehouse optimization.

When evaluating warehouse optimization opportunities, different areas can be targeted, starting with the picking process, which is retrieving products from where they are stored in the warehouse and moved to a location for next-step processing (Dobrilovic et al., 2012; Mirabelli et al., 2013; Rupasighe & Dissanayake, 2018). The associated expense for picking could be as high as 55% of the cost in a warehouse (Dobrilovic et al., 2012). The picking process can be impacted by evaluating not only the location of the stock in the warehouse and moving them based on their processing frequency closer or further from the processing area, but also by choosing optimal racking placement and

travel paths to store and move the product within the warehouse (Bao et al., 2019; Dobrilovic et al., 2012; Rupasighe & Dissanayake, 2018). The next area to be evaluated is the physical space being utilized in the warehouse. There are costs to maintain a warehouse, including utilities, the storage space being taken up by slow-moving inventory, or wage expense from paying employees that are not needed due to inefficient warehousing processes (Lyu et al., 2020). Evaluating product that does not have a frequent inventory turn and replacing that product with inventory that is turning more quickly can assist with cost reduction (Rupasighe & Dissanayake, 2018). Placing stock in an optimal location within the warehouse is also beneficial as it improves the warehouse employee's processing rate (Dobrilovic et al., 2012). This optimal location may be within the warehouse or in the storage racks or bins where the product is stored and retrieved (Bao et al., 2019). Warehouse processes such as retrieval, picking and packing, and storage can be inefficient and add cost to a warehouse. Opportunities to make these processes more efficient should be evaluated.

Warehouse Automation

Warehouse automation is defined as using equipment to move and store products without the addition of staffing (Baker & Halim, 2007). Automation can be an area that allows organizations to increase their cost-effectiveness and operational productivity (Ramaa et al., 2012; Shatat & Udin, 2012). Automation not only improves efficiency but reduces the number of times human interaction occurs, which in turn reduces errors (Ramaa, Subramanya & Rangaswamy, 2012), and there has been a growing interest to evaluate warehouse automation as organizations look to offer a more comprehensive

variety of products (Dubey & Veeramani, 2017). There are many ways supply chain leaders can automate their warehouses to include conveyor systems, automated sortation equipment that aids in the movement of products within the warehouse, and forklifts that will pick, pack, and store products (Baker & Halim, 2007; Nicolas et al., 2018). Automating the storage and retrieval of a product within warehouses will improve cost-effectiveness, increase efficiency, and improve customer service (He et al., 2018). Customer service and accuracy are ever-increasing dynamics given consumer demand, and using technology and automation can ensure products, mainly critical items, are processed quickly and efficiently (van Wingerden et al.,2019). Autonomous vehicles that move products within warehouses are guided with wireless technologies to the product location (Kattepur et al., 2018). The process is further enhanced by using barcoding or radio frequency identification to guide the vehicles to the specific product location, which improves the overall efficiency of the storage or retrieval processes (Tejesh & Neeraja, 2018). Warehouses are a considerable organizational expense (Baker & Halim, 2007) and are vital to ensuring customer service expectations are met (Baker & Halim, 2007; He et al., 2018). Given the importance, a supply chain leader's evaluation and potential warehouse automation implementation cannot be overlooked.

Industry 4.0 and the IoT

Innovation often is a byproduct of new technologies being used to enhance existing processes. Industry 4.0 and the IoT are such technologies that can be evaluated to improve manufacturing supply chains. Industry 4.0 and the IoT are additional areas that manufacturing organizations can consider to improve supply chain performance,

profitability, competitiveness, and customer service (Aryal et al., 2020; Ben-Daya et al., 2019; Bento & Tontini, 2019). Industry 4.0, also known as smart manufacturing, is the connectivity and integration of communication and industrial technologies (Ben-Daya et al., 2019; Chiarini et al., 2020). Industry 4.0 is defined as the connectivity of products and services via a network or the internet (Hofmann & Rüsch, 2017) and is further described as using technology to improve industrial processes to enhance flexibility and efficiency (Machado et al., 2020). These products or services could be autonomous warehouse vehicles, warehouse automation, or other technological or data-driven processes without direct human intervention (Hofmann & Rüsch, 2017; Kusiak, 2018). The importance of streamlining processes to drive efficiencies in the supply chain has been detailed previously in this study. If using the integration of automation, technology, and data information further enhances the organizational leader's ability to accelerate the desired changes within manufacturing supply chains, smart manufacturing needs to be evaluated and implemented where opportunities for improvement exist. The options will vary by organization, but areas that should be targeted for evaluation are currently performed by humans that could be achieved by technology (Kusiak, 2018; Machado et al., 2020) or processes that can be accelerated or improved by using technology (Bento & Tontini, 2019). Industry 4.0 or smart manufacturing has garnered more attention in manufacturing industries (Sony, 2018; Tortorella & Fettermann, 2018). This is primarily due to its impact on organizational effectiveness (Aryal et al., 2020; Chiarini et al., 2020). According to Hoffman and Rüsch (2017), the IoT is a precursor to Industry 4.0 and is defined as intelligent and connected products. These products are more robust than their

traditional counterparts, more reliable, and usable. They can connect an organization's supply chain making it more agile, interactive, and improve supply chain processes (Ben-Daya et al., 2019). With the accelerated evolution of manufacturing, IoT has been under consideration and evaluation by supply chain leaders (Kusiak, 2018). Industry 4.0 can benefit manufacturing organizations and their supply chains (Aryal et al., 2020; Xu et al., 2018). IoT and other technologies will create enhanced or new business models in the manufacturing industry (Zhou et al., 2018). It will allow supply chains to exceed current demand levels and be positioned for rapid evolution (Aryal et al., 2020). As the need for more versatile and robust supply chains increase, the technology that enables them to achieve the desired flexibility to communicate across all of the supply chain nodes will also need to advance to the next level (Ben-Daya et al., 2019), and IoT will be a driving force to allow that to happen. Industry 4.0 and IoT are technologies that manufacturing organizations can implement to enhance existing processes. Current processes can include but are not limited to autonomous vehicles, automated inventory systems, or sortation, which can improve manual processes' efficiency. Given that IoT and Industry 4.0 are technology-focused enhancements, data is readily available, and analyzing it can lead to additional supply chain improvements.

Data analytics is a significant focus of Industry 4.0 and IoT, given the technology and information required to ensure organizations are continually improving their supply chain efficiency (Aryal et al., 2020). When determining what will be one of the most significant factors to allow supply chain leaders to effectively manage the organizational and demands of the supply chains they oversee, utilization of data analytics is necessary

(Baryannis et al., 2019). While data analytics' relevance and how it can improve supply chain performance is understood, the ability to implement and integrate manufacturing organizations is still problematic. There are vast amounts of data, and some manufacturing supply chain processes are not easily identified (Chiarini et al., 2020; Kusiak, 2018). Data analytics are important to manufacturing organizations technological advancement (Xu et al., 2018), and supply chain leaders realize that their organizations will need to find opportunities to incorporate data analytics processes into their supply chains to ensure success and the ability to make decisions timelier (Aryal et al., 2020; Xu et al., 2018). Finding opportunities to analyze, understand, and incorporate data into identifying supply chain processes that can further enhance organizational effectiveness is critical to evolving and improving organizational supply chains. Improving processes is an essential component for supply chain success and developing practices that drive that will accelerate the desired supply chain improvement results.

Lean Six Sigma

Lean and Six Sigma quality initiatives are metrics and processes that organizations can implement to improve supply chain performance. Lean and 6S focus on making processes and projects more efficient (Andersson & Pardillo-Baez, 2020; Cesarotti, 2019). These improvement methods are widely used in manufacturing as they can reduce defects, standardizes manufacturing processes, and reduces costs (Andersson & Pardillo-Baez, 2020; Ben Romdhane et al., 2017; Chen et al., 2017; Jordan et al., 2019). Lean and 6S work in conjunction with each other; lean focuses on process flows and reducing waste, while 6S is centered on design and contrast (Andersson & Pardillo-

Baez, 2020; Jordan et al., 2019). Competitive advantages benefit from lean and 6S initiatives (Cesarotti, 2019; Juliani & de Oliveira, 2020; Mehmood & Afzal, 2019).

Manufacturing organizations benefit from lean and 6S initiatives as they impact quality by reducing errors. Cost containment is also a realized benefit as processes are changed to make them simpler and focused on eliminating unnecessary steps and improving operational performance. Organizations need to look for opportunities to implement lean or 6S to improve quality, reduce costs, and increase competitiveness.

Blockchain

Innovation in manufacturing supply chains is the focus of this study's research. Evaluating opportunities to innovate the supply chain focuses on known technologies and newer technology. Blockchain is a unique, innovative technology and potentially a disruptor in manufacturing supply chains (Wong et al., 2020). Manufacturing supply chains are becoming increasingly complex due to globalization and the procurement of goods (Westerkamp et al., 2019). When factoring in regulations, currency exchange rates, and customer expectations, the need for solutions to incorporate all these variables is a necessity and blockchain, which is defined as a shared database of all digital transactions (Chang et al., 2020; Hofmann & Rüsch, 2017; Saberi et al., 2019). The blockchain data ledger is based on the same premise as a traditional ledger, with the added functionality that the ledger and the entries can be added, updated, and validated by all involved parties (Queiroz et al., 2020). Innovation can consist of modifying existing systems or evaluating new technologies that enhance existing processes. Blockchain is such a technology that allows information access to multiple networks across the supply chain, streamlining

information flow. Given its relative newness, this technology still requires assessing the potential impact on supply chains. At this stage, it appears to be an innovative way for stakeholders to add visibility while maintaining data security.

Given blockchain and its impact on the supply chain is new and innovative, it has not been widely researched academically (Pournader et al., 2020). It is known that supply chain leaders have been hesitant to share data given the vulnerabilities, but with blockchain technology, many of those concerns will be alleviated (Baryannis et al., 2019). Chang et al. (2020) stated that blockchain technology can have different permissions, public or private, and is secure and tamper resistant. The willingness or lack of agreement on which pieces of data could be safely shared will no longer be a concern as all of the information will be transparent to all involved parties (Rahmanzadeh et al., 2020). Manufacturing supply chain leaders need to evaluate opportunities where blockchain can be implemented. Many organizations have already started to use blockchain technology to integrate manufacturing processes (Xu et al., 2018). The World Economic Forum (2015) estimates that 10% of the world's Gross Domestic Product will be archived on blockchain technology and if supply chain leaders do not find ways to implement blockchain, they risk impacting their future profitability, service, cash flow, and competitiveness (Chang et al., 2020). Blockchain technology will allow supply chain executives in manufacturing organizations to take advantage of the data sharing to make transactions transparent and secure while reducing the average transaction time. Utilizing blockchain technology to provide access and information sharing will help mitigate supply chain risk.

Supply Chain Mitigation

When supply chain leaders are looking to implement innovative supply chain strategies, they are not limited to those centered around technology. Given the changes in supply chains over the last two decades, the importance of supply chain mitigation or developing a contingency plan has increased considerably (Baryannis et al., 2019). According to Birkie and Trucco (2020), supply chain disruptions occur more frequently. Supply chain disruptions result from unplanned events that impact an organization's supply chain (Carbonara & Pellegrino, 2018). These unexpected events could be a result of natural disasters (Aqlan & Lam, 2015; Baryannis et al., 2019; Singh & Singh, 2019) or other internal and external conditions beyond an organization's control (Aqlan & Lam, 2015; Min et al., 2019). These conditions could include competitive threats, limitations, or challenges given that many products and materials are being sourced internationally, sales or production spikes or lulls, and that many organizations are relying on lean manufacturing processes and just in time inventory practices, which can exacerbate the supply chain risk (Aqlan & Lam, 2015; Singh, 2020). Disruptions in the supply chain, regardless of natural disasters or human-made situations, can be detrimental to an organization. Ensuring that organizations are prepared for such disruptions will minimize the impact or reduce the recovery time required to get back to complete production levels.

When assessing an organization's supply chain risk level, an in-depth assessment must be completed to understand where the deficiencies or vulnerabilities lie (Mohammaddust et al., 2017). This assessment should evaluate the whole supply chain,

including, but not limited to, sourcing of products and materials and alternative sourcing options (countries and suppliers), warehouse capacity, competition, customer base, labor climates, and current global events that may increase risk (Aqlan & Lam, 2015; Singh, 2020). When supply chain leaders have performed a thorough analysis of their supply chain and potential risk areas, they can begin developing contingency plans to minimize or prevent supply chain disruptions. Supply chain organizational leaders that have developed adequate contingency plans will put organizational supply chains in a state of preparedness that will allow a continued performance of critical processes that will minimize impact to the day-to-day operations if a disruption occurs (Baryannis et al., 2019). Implementing supply chain mitigation processes will ensure that organizations are still able to operate even if at a reduced capacity and will be able to recover more quickly if a mitigation plan is in place (Birkie & Trucco, 2020). Evaluation of the supply chain and potential points of failure that may exist is critical for organizational preparedness. Given the ever-increasing complexity of supply chains, frequent evaluation of supply chains and adjustments to mitigate risk are important.

Supply chain leaders need to be innovative and develop supply chain mitigation strategies to be prepared for situations that may arise (Min et al., 2019; Mohammaddust et al., 2017). Supply chains are increasing in complexity (Birkie & Trucco, 2020), and to manage the challenges of an ever-increasing supply chain, organizations that can react to changes and implement adjustments quickly will recover more rapidly and will be able to maintain a competitive advantage (Birkie & Trucco, 2020; Carbonara & Pellegrino, 2018; Singh, 2020). Supply chain leader's continual evaluation and adjustment to the

areas of their supply chains that have the potential to be impacted by disruption will ensure that their organizations are best positioned to manage risk and be able to navigate any vulnerabilities that may be encountered (Mohammaddust et al., 2017). Supply chain executives need to identify and mitigate supply chain risks. This is accomplished by continually evaluating changes that impact the supply chain and implementing solutions to reduce the potential impact.

Transition

Section 1 included an introduction to the research of my doctoral study. The specific business problem was that some organizational supply chain leaders lack innovative supply chain strategies within the manufacturing sector. The purpose of this qualitative, multiple case study was to explore the innovative supply chain strategies that supply chain leaders in manufacturing organizations use to achieve supply chain flexibility. I evaluated three possible research methods and chose a qualitative methodology as the most appropriate as my research included interviews with supply chain leaders in manufacturing organizations. The data that I collected was analyzed and will help supply chain leaders in manufacturing organizations assess and implement innovative supply chain strategies to improve organizational performance. Section 1 also includes the study's foundation, a background of the problem, research question, key term definitions, assumptions, limitations, delimitations, the significance of the study, and a review of the academic literature.

Section 2 included an overview of the data collection methodologies used to demonstrate that supply chain innovation can positively impact organization supply

chains. Section 2 consists of the study's purpose, the criteria used to select the participants, an overview of the population and sampling; the ethics of the research; how the data was collected and analyzed; and specifics on the reliability and validity of the study. Section 3 will include the findings, practical application of the research, and future academic research potential.

Section 2: The Project

Section 2 consists of a restatement of the purpose of the study, an overview of the research, an explanation of my specific role as the researcher, a discussion of the participants that were part of the study, and a justification for research method and design used. Following those components, I present the population and sampling, ethical research procedures, data collection methodology, and data organization techniques. The section concludes with an analysis of the data, a discussion of the reliability and validity of the study, and the transition and summary.

Purpose Statement

The purpose of this qualitative, multiple case study was to explore the innovative supply chain strategies that supply chain leaders in manufacturing organizations use to achieve supply chain flexibility. The population consisted of five supply chain leaders in the midwestern U.S. manufacturing industry who implemented technologically innovative solutions. I chose these organizations because they had successfully implemented innovative strategies to improve efficiency and profitability in their supply chain functions. These more efficient supply chain processes could result in fewer shipment delays, a more quality designed and assembled product, and a reduction in returns and recalls, benefitting customers. By improving the product quality and reducing recalls, society may benefit from not using defective products that may compromise their safety and well-being. Organizations' sustainability can also benefit through reduced fossil fuel consumption and fewer carbon emissions.

Role of the Researcher

In qualitative research, the researcher is the primary means of data collection, analysis, and interpretation (Chenail, 2011). In my role as the researcher in this study, I collected data via one-on-one or remote video interviews with participants in such a manner as to eliminate bias or preconceptions that may have arisen. The information that I collected allowed me to better understand supply chain innovation and the supply chain leaders' perspectives to address the research question.

My professional experience in the research area consists of working for a logistics company in different capacities for 31 years. Some of that experience has included work with technological innovation and working with external customers that work in the manufacturing industry.

I complied with the guidelines and ethical principles detailed in *the Belmont Report* and required by Walden University's Institutional Review Board (IRB). These ethical considerations ensure that the interviewees are protected to prevent any inadvertent repercussions and keep them anonymous if they so desire (Jacob & Furgerson, 2012). These ethical considerations also include adhering to the principles outlined in *the Belmont Report*, which are focused on protecting the participants that are providing information in the research process (Brakewood & Poldack, 2013).

I conducted semistructured interviews to gather data for this study. The interview questions were open ended to allow for engaging discussion (see Jacob & Furgerson, 2012), which affords a better understanding of the data from the interviewee's perspective (see Alby & Fatigante, 2013). The interview questions I asked were focused

on supply chain innovation and the factors and metrics presented when supply chain executives implemented innovative supply chain solutions. The questions followed a predetermined script (i.e., the interview protocol) that guided the interview process (see Jacob & Furgerson, 2012). My rationale for using an interview protocol was for consistency and to keep me accountable to the study and the defined interview process. The participants I interviewed were supply chain leaders in manufacturing firms who were knowledgeable about supply chain innovation and had the authority or responsibility to implement such innovation.

After I completed the interviews, I then analyzed and interpreted the collected data. My research and practical experience allowed me to understand and synthesize the data, but I also needed to be mindful that it may have influenced my interpretations of the data. Challenges may arise when interpreting data, and a researcher needs to ensure that their personal experience does not affect that interpretation. The researcher will perform a more thorough discovery of research if they are aware of any potential of bias (Smith & Noble, 2015). I mitigated bias by adhering to the interview protocol and being consistent by asking the same interview questions of each participant. The interview protocol is in Appendix B. I further reduced bias by recording and transcribing the participants' responses and sharing the results with the participants for validation. Validating the responses with the participants limited researcher bias in this study.

Participants

The participants were supply chain decision makers that work in industrial manufacturing organizations in the midwestern United States. The inclusion criteria

required participants to be decision makers in their respective organizations who had implemented an innovative supply chain solution that has driven a positive business change. Positive business change was defined as a solution that has improved supply chain flexibility, increased supply chain efficiency, had a positive financial impact, increased competitiveness, or enhanced mitigation of the organizational supply chain. I gained access to the participants via introductions and referrals from trade associations, economic development entities, and mutual connections. Once I gained access to them, I established a working relationship by calling or emailing the prospective participants, providing an overview of the study, reassuring them of the study's confidentiality, and sharing a copy of the consent form. The process to obtain the five participants for the interviews began with getting their approval while adhering to the Walden University IRB requirements and approval processes. I used purposive sampling to select the five participants I interviewed.

Once I determined that the five participants met the eligibility requirements, they were briefed on the IRB approval process to ensure that they knew the criteria and the importance of my protection of their identities if they so desired. I informed the participants of the study's benefits, risks, and confidentiality procedures by reviewing the consent form (see Appendix A). I also complied with any internal organizational approvals or processes that that were required by the organizations that they worked for. The participants' identities and interview responses will be kept confidential and stored on a password-protected laptop for 5 years before being destroyed. I used a consistent set of six interview questions for each participant. As a researcher, I realized that not all the

participants would interact the same and that they would perceive the questions or understand the study differently (see Hoffman, 2009). Participants may have also interpreted the questions differently based on their experiences (see Goldblatt et al., 2011). Interviews allow for in-depth responses that provide the participants' insights based on their experiences and knowledge (Mikene et al., 2013).

I conducted qualitative interviews using qualified participants to answer the research question. Communicating with the participants before, during, and after the process ensured that they knew the benefits and risks of participating in this study. Complying with the Walden University IRB guidelines and obtaining the necessary preapprovals ensured that I followed the proper procedures and that the participants' identities and responses were kept confidential.

Research Method and Design

Qualitative research is the immersion in and understanding of people's real-world and practical experiences (Chenail, 2011). Experiences can comprise different roles the individual participated in from a personal or professional perspective (Rowley, 2012). A multiple case study approach is used to compare each participant's responses (Yin, 2017).

Research Method

The qualitative method was the most appropriate approach for determining supply chain innovation levels that manufacturing supply chain leaders have leveraged to improve an organization's supply chain flexibility and positively impact metrics within their organizations. Qualitative research can allow the researcher to better understand the causes and consequences of their hypothesis (Bernard, 2013). In this doctoral study, I

focused on the trends and motivations that manufacturing supply chain leaders leverage to drive change within their organizations. Qualitative research is well suited for understanding behaviors, trends, motivations, and what drives them (Bailey, 2014). Many researchers also find that using a qualitative research method and interviewing the participants allows for a greater understanding of what drives trends (Yin, 2017). I conducted interviews with manufacturing supply chain leaders to collect data, which was an effective way to gather information and develop a greater understanding of the research topic (see Rowley, 2012).

Quantitative research focuses on data and statistics to validate variables (Yin, 2017) and is best suited for the natural sciences (Allwood, 2011). In quantitative research, close-ended questions are used that attempt to fit information into specific categories (Yilmaz, 2013). Close-ended questions were not an appropriate format to study this research topic as it would limit the participant's ability to share their experiences.

A mixed-method approach combines qualitative and quantitative methodologies. Mixed methods are best suited to address potential limitations in quantitative or qualitative methodologies (Caruth, 2013). A mixed-method approach is more detailed, and that level of detail was not needed for this research topic. Because interviews provide adequate details covering experiences, values, and processes (Rowley, 2012), these details and experiences provided the necessary detail to support this exploration of the research topic. The additional information provided by a mixed-method approach would have been too expensive and time intensive for the current study.

Research Design

In this study, I aimed to determine the level of innovation that manufacturing supply chain leaders use to achieve supply chain flexibility and drive critical business metrics. I considered five qualitative research designs for use in this study: (a) case studies, (b) grounded theories, (c) narrative research, (d) participatory action research, and (e) phenomenology (see Bernard, 2013). Choosing the appropriate design is critical when evaluating the different qualitative research designs available because the research design allows the researcher to establish and set the study's tone (Yin, 2017). Phenomenological research centers on the participant's lived experiences (Marshall & Rossman, 2016). Because this study focused on how supply chain executives implement innovative solutions and was not centered on the participants' experiences, the phenomenological design was not suitable. A participatory action research design focuses on the participants' challenges and their solutions to address those challenges. The participants are often community members or community organizations, and given those variables, this theory was not suitable for the current study. A grounded theory design focuses on collecting and analyzing qualitative data from diverse populations (Marshall & Rossman, 2016). Given that I conducted this research by interviewing five participants from the same population (i.e., manufacturing supply chain leaders), a grounded theory design was not appropriate for this study. A narrative research design consists of gathering and interpreting chronological data from participants' experiences (Marshall & Rossman, 2016). Because I was focused on established consistencies among

manufacturing supply chain leaders and not individual experiences, the narrative design was not suitable for this study.

I chose a qualitative method and determined that a case study design was the best choice for this study. When using case study designs, data collection methods are often combined, such as interviews and observations (Baxter & Jack, 2008, Stake, 1995; Trkman, 2010). Researchers use case study designs to understand areas that are still in the discovery and emerging stages (Andrade, 2009; Trkman, 2010). There are two types of case study designs to choose from: (a) a single case study and (b) a multiple case study. A single case study is used to contrast the findings against existing theories (Yin, 2017), and because I did not test against existing theories, I did not choose this design. A multiple case study design is used to compare similar results or findings to each other (Yin, 2017). Because my goal was to compare the innovative logistics successes of manufacturing supply chain leaders, a multiple case study design was the most appropriate.

Researchers prefer case study designs when asking open-ended interview questions (Andrade, 2009; Baxter & Jack, 2008; Yin, 2017). I compared five organizations and their supply chain leaders by asking a series of open-ended questions that allowed me to ascertain the successes of supply chain innovative solutions. Comparison of multiple organizations aligns with a multiple case study design (Yin, 2017). Data saturation occurs when no new information emerges from the interviews (Braun & Clarke, 2019). After five interviews, I reached data saturation when I began to receive the same information from the participants. I validated saturation by comparing the transcripts to ensure that no new themes were present.

Population and Sampling

In this qualitative, multiple case study, the population was executive managers in the supply chain manufacturing industry located in the midwestern United States who had successfully implemented innovative supply chain strategies in their organizations. The participants included those employed in midsized manufacturing organizations and decision makers or executives in the organization's supply chain department or function. I employed the purposive sampling method, a nonprobabilistic sampling procedure, because sampling is critical to synthesizing qualitative research quality (see Suri, 2011). Purposive sampling is often used in qualitative research and helps gather the information that adds value to the study (Palinkas et al., 2013). Qualitative purposeful sampling captures information from smaller sample sizes more efficiently than quantitative sampling, which is effective with larger population sampling (Patton, 2007).

I contacted the prospective participants either in person or via email and conducted all interviews via Zoom video calls. I leveraged multiple resources to identify the potential interview candidates and protected their privacy and confidentiality if they so desired. To ensure data saturation occurred, I interviewed participants and compared responses until no new themes emerged.

Ethical Research

To ensure that the data I gathered were accurate, I offered the participants the opportunity to keep their identities and their organizations' identities confidential. I followed standards to protect the participants, including receiving informed consent from the participants before collecting data and informing them of their right to remain

anonymous and that I would keep their responses confidential. If the participants decided not to continue, they were allowed to withdraw from the process without repercussions (see Stacey & Stacey, 2012). I provided the participants with my contact information and emphasized that at any point during the process, even after data collection, they could contact me and withdraw from the study. If a participant chose to withdraw, they were allowed to do so without ramifications.

Walden University's IRB must approve the ethics review and recruitment processes before interviewing the participants. The IRB approval number was 07-07-21-0016880. I reviewed the informed consent form with all participants before starting the interviews. Participants signed the consent form (as shown in Appendix A) before the interviews. Reviewing the consent form with the participants while obtaining their signature reinforces the study's risks and helps mitigate any concerns the participants may have (Stacey & Stacey, 2012). The informed consent document must review the importance of protecting confidential data and what information may be disclosed by the researcher (Check et al., 2014). The researcher's role is to understand what risks or harm the participants may experience (Ahern, 2012; Stacey & Stacey, 2012). The researcher has the responsibility to protect and manage the participant's information. Protecting the researcher will protect them from undue criticism from those who may read the research (Ahern, 2012).

I adhered to *the Belmont Report* and Walden University's IRB guidelines and ethical principles. Ethical principles of *the Belmont Report* include respect for the people participating in the study, informed consent, and communication of the risks and benefits

of participating in the study. Participants were selected indiscriminately from those that met the initial screening criteria.

The consent form was e-mailed to the participants in advance of the interview to allow them enough time to decide if they wanted to participate. It included information on the (a) research topic, (b) research process, (c) that participation is voluntary and that there are no business considerations or concessions because of the interview process. The consent form also reviewed the (d) risks and rewards of participating in the doctoral study interview process and (e) the interviewees' confidentiality and their respective organizations if so desired. The consent forms and interview responses are archived on a password-protected laptop for security purposes. Physical documents will be locked in a storage cabinet accessible by me. Five years after my study's completion, I will destroy all physical copies by shredding them, and any electronic data will be erased. The participants may request anonymity at any time during the interview process, and the participants can withdraw from the interview process at any point they desire. The interviews were conducted via Zoom audio conference and recorded to allow transcription and analysis.

There was no business arrangement negotiated for the responses I received. There may be preexisting business relationships with the participant's organizations and the organization that I work for, but there was no exchange of services for the responses, nor was any consideration given if there was no preexisting business relationship.

Data Collection Instruments

The primary data collection technique for this doctoral study was semi structured interviews. Secondary and tertiary data instruments consisted of company documents and industry journals. Interviewing was the primary means of collecting data (Rowley, 2012) and interviews are essential sources of collecting data (Yin, 2017). The researcher is the main instrument regarding data collection and analysis (Cleary et al., 2014). I used semi structured interviews to gather a greater understanding of the manufacturing supply chain leader's strategies that drive organizational efficiencies, flexibility, and profitability. Semistructured interviews are relevant when researchers strive for a more thorough understanding of the research topic. The interview approach asked open-ended questions and allowed for participant flexibility when answering the questions (Rubin & Rubin, 2012).

The questions that I asked served as the primary collection instrument. I asked the six questions (as shown in Appendix C) in a consistent order for each of the participants. To ensure consistency, I leveraged an interview protocol (as shown in Appendix B). I recorded the responses, and the supply chain leaders also provided secondary collection instruments such as organizational documents and additional metrics to support their perspectives. The open-ended questions facilitated responses, and I used follow-up questions when appropriate to gain a more thorough understanding of the responses they provided, which further drove the body of research. As the researcher and interviewer, it is important to be cognizant of the potential for bias and ask questions, so a position of power does not develop while maintaining a discussion or dialogue (Anyan, 2013). It is

also vital that the researcher listens to the participant's responses (Yin, 2017) and asks questions to clarify the responses to ensure I have the details needed for the research topic. This additional validation will add credibility to the body of work, aid in the facilitation of data synthesis, and demonstrate a thorough understanding of the participant's responses.

There were three means of data collection for this study, semistructured interviews, organizational documents related to supply chain innovation strategy and deployment, and industry journals validating innovative supply chain solutions deployed in organizations. The semistructured interviews, the primary collection method, were supported by the secondary and tertiary data collection instruments.

To enhance the data collection process's reliability and validity, I used member checking and transcript checking. Member checking provides participants with a copy of the data to validate the researcher's interpretation of the data (Cho & Trent, 2011). Transcript checking is the process of sharing the transcribed data with the participants (Street & Ward, 2012).

Data Collection Technique

Data collection involves gathering information that supports your research (Alasuuturi, 2010). Interviews are used for data collection (Rowley, 2012) and are viable sources for data collection (Yin, 2017). I used semistructured face-to-face interviews as my data collection method to address my research question to what hat innovative supply chain strategies do manufacturing sector supply chain leaders using to achieve supply chain flexibility. There are advantages to using face-to-face interviews; it allows for

discussion with the participants and creates a better rapport between the researcher and the participants (Mojtahed et al., 2014). Additional advantages are that the interviewer can determine if the question is not straightforward and that the participant is dedicating their time to the interview process and not being distracted. Disadvantages of face-to-face interviews include the participant's responses being influenced by my presence (Mojtahed et al., 2014). My taking notes may have been a distraction to the participants or impact how they responded. Having an interview protocol (see Appendix B) will help control the disadvantages. Participants were informed that their responses were recorded to allow transcription to ensure their integrity is not impacted. I also took notes while the participants respond to the pre determined interview questions. If the participants deviated or expanded on their responses, I leveraged the interview protocol to get back on track.

After receiving approval from Walden University's IRB, I contacted potential interviewees via email and included a consent form (see Appendix A) for them to sign and return. Once they had completed the consent form, I scheduled interviews with them. Given the current environment created by COVID-19, the face-to-face interviews were replaced with video conference calls using Zoom. Any organizational documents pertinent to the research shared with me as well the responses to the questions I asked were categorized. The documents and the answers demonstrated that the interviewees are subject matter experts in supply chain innovation.

Throughout the interview data collection process, I used member checking to validate the information collected (Street & Ward, 2012). Member checking includes

sharing my interpretation of the participant's responses. I ensured that the transcription of the data was consistent and accurate with the participants' responses. To remain consistent regarding the validation of the data collected, I reviewed with the participants after each question asked. I also reviewed the transcribed data with the interviewees to ensure that the transcription process was consistent with their responses, which also supported research validity (Cho & Trent, 2011).

Data Organization Technique

Researchers must organize and document the data (Yin, 2017). Researchers can collect and record data by looking for patterns, common response categories, or other trends that the researcher identifies. Scholars recommended that using the best practices of other researchers be followed as a guide to data organization (Yin, 2017). A researcher can also use the interview process as part of the data organization strategy, including the interview planning, actual interview process, and synthesizing the interviews itself (Rowley, 2012). I used the NVivo qualitative data analysis software to organize, analyze, and find insights based on the participants' responses.

To store the participant's transcribed interviews, I used a password-protected flash drive. Data may be temporarily stored on my password-protected laptop during the actual interview process and data organization and analysis. I kept a journal detailing the contact and communication with the participants in the data collection process. Once all data processes were completed, all data, digital or hard copies, will be stored in a locked desk for 5 years. After 5 years, all hard copies documents will be shredded and digital copies deleted and destroyed.

Data Analysis

Data analysis is a detailed process of gathering the data and synthesizing it (Rowley, 2012). Data interpretation is critical in the research process as it allows for a better understanding of the data that has been collected (Yin, 2017). A review of the literature to include an understanding of supply chains, innovation, and leveraging innovation to drive successful business results and understand the innovative strategies that manufacturing supply chain managers use to improve organizational success. The questions used to gather the research will aid with data analysis given the focus on supply chains, innovation, and leveraging innovation to drive change in an organization's supply chain.

After conducting the interviews, the next step is to approach the data analysis in an organized and consistent manner (Bernard, 2013). To ensure consistency, I developed an interview protocol (see Appendix B). The steps that I followed to analyze the data and ensure consistency were:

1. Listen to the recorded responses and read the transcriptions from the recordings.
2. Determine consistencies between the responses.
3. Group and label responses that share common themes.
4. Develop categories (potential headings) based on supply chain innovation impact.
5. Conduct a thorough analysis of the data to ensure I understand commonalities and impact on the research.

6. Write the findings.

After I reviewed, compiled, read, and interpreted the data collected from the interviews that was in a consistent and unbiased manner, I analyzed the data. I then categorized the data into themes as identified by the participants and grouped them according to commonality as recommended by Yin (2017). My analysis focused on data pertaining to supply chain innovation and the implementation of strategies that positively impact the supply chain. I used the data collected to support the research question, fill the literature gap, and aid with future research. All the responses were recorded to include additional responses from follow-up or clarification questions. All the questions will be transcribed and free from interpretation or bias, meaning the data will speak for itself. Any supply chain experiences or knowledge that I possess did not influence the subsequent conclusions that I captured from the responses. I validated that the interview questions' analysis and the outcome were consistent with the area of research. As recommended by Yin (2014), I grouped the collected data into consistent themes and perspectives to demonstrate the responses' commonality. My analysis of the data looked for evidence of supply chain innovation strategies that drove successful business change. I analyzed the data to (a) answer the research question, (b) address the potential gap in the available literature, and (c) to motivate others to conduct additional research on the topic. I used NVivo qualitative data analysis software to capture, organize, and process participants' responses. NVivo allows researchers to analyze text, audio, and video from interviews and surveys. I transcribed the participant’s responses and input the responses

word-for-word into NVivo. NVivo will then identify trends and themes in the interview data, which provided me the necessary research for my study.

According to Denzin and Lincoln (2011), triangulation of the data consists of analyzing different data sources to determine commonalities. The four types of triangulation are (a) data triangulation, (b) investigator triangulation, (c) theory triangulation, and (d) methodological triangulation (Denzin & Lincoln, 2011). Researchers use methodological triangulation to compare multiple sources of data (Fusch & Ness, 2015). The use of various data sources, such as interviews, direct observation, participant observation, and documents, can reduce bias and enhance the validity and credibility of research findings (Yin, 2017). I used methodological triangulation consisting of semistructured interviews, company documents, and industry journals.

Reliability and Validity

When conducting a qualitative study, the researcher must document the steps (Yin, 2017). To ensure reliability and validity, I was transparent throughout my research. Research can lose credibility without supportive detail regarding reliability and validity (Morse et al., 2002). Others reading will consider validity and reliability when determining its practical value (Bleijenbergh et al., 2011). Using established reliability and validity practices legitimize scholarly research (Yin, 2017).

Reliability

In research, reliability has a direct correlation to dependability and how the researcher not only supports their area of study but provides the processes, results, and references to demonstrate scholarly rigor (Cho & Trent, 2011; Morse et al., 2002). To

ensure transparency, I was consistent with the interview process, using a script to not deviate from the predetermined questions and have reviewed the questions to ensure no ambiguity. The questions were free from bias. I transcribed the recordings to prevent any misinterpretation of the data. To ensure dependability, I shared the transcribed data with the participants. I also member-checked the data collected with the participants. The documented responses were shared with each respondent to enforce reliability further. In qualitative studies, you can improve research quality when supported by credible data collection methodologies (Cho & Trent, 2011). The researcher can also support the data by including peer-reviewed literature and multiple sources.

Validity

Empirical research relies on the validity of the information collected (Street & Ward, 2012). I reinforced the validity of the study by emphasizing the importance of the participants' responses and their willingness to participate in the interview and research process (Aust et al., 2013). Member checks with the participants through the interview process can further support validity while adding credibility to my research (Street & Ward, 2012). Member checking ensures the participant's responses are accurate and supports the research (Cho & Trent, 2011). Member checking is the process of validating my interpretation of the data with the participants. My role as the researcher stressed that I need to be consistent with the methodologies applied, the comprehensive peer-reviewed resource gathering processes, and the selection of the supply chain leaders chosen for the interviews also support the validity of the research.

Transferability of the information to other researchers looking to conduct their current or future research or supply chain leaders within manufacturing or other industries looking to implement innovative strategies will also enhance the validity of the research. Qualitative research's transferability and validity are more credible when documented processes, methods, and techniques are followed (Cho & Trent, 2011).

Confirmability of the research is essential when emphasizing validity (Cho & Trent, 2011; Morse et al., 2002). As the researcher, I addressed confirmability by tracking the history of the data collection process, preserving the data and data sources in the event other researchers or practitioners have questions regarding the research or the applicability to further academic research or organizational transferability.

Data saturation is an integral part of research validity. Having the correct sample size, consisting of knowledgeable people in research, will allow for optimal saturation (Morse et al., 2002). To support the necessary level of saturation, I conducted interviews with five supply chain decision-makers in manufacturing firms. This number was sufficient to achieve data saturation, meaning no new information would be obtained by interviewing additional participants. If I had not obtained data saturation, I would have interviewed two additional interview candidates in reserve.

Transition and Summary

Supply chain managers in manufacturing firms need to understand better how to capitalize on innovation to achieve better supply chain flexibility. This section addresses a qualitative, multiple case study that contains research to support such initiatives. The section also included the purpose statement, my role as the researcher, and an overview

of the participants interviewed for the study. The section then provided an overview of the research method and design, the population and sampling, and the ethical guidelines that will govern how the participants and data will be protected. The section then concluded with an overview of the data collection instruments and methodologies and the research's reliability and validity.

Section 3 will cover the presentation of the findings and how these findings will impact social change. How I used the research for academic and practical purposes will be analyzed to include potential further research areas. Lastly, I reflected on the research experience and then wrapped up with an overall statement on the completed research.

Section 3: Application to Professional Practice and Implications for Change

Introduction

The purpose of this qualitative, multiple case study was to explore strategies that supply chain leaders in manufacturing organizations use to achieve supply chain flexibility. I interviewed five participants in the midwestern United States with experience implementing innovative supply chain solutions. The participants were all supply chain decision makers at the senior leadership level and responsible for making decisions regarding their organization's supply chain function. I also evaluated physical documents from the organizations for data triangulation that supported the participants' interview responses. I analyzed the interview data using NVivo. The five themes that emerged from data analysis were (a) technology aided in improving efficiencies in organizational supply chains, (b) financial considerations were an important consideration when determining to deploy innovative supply chain strategies, (c) cross-functional collaboration improves when evaluating or deploying innovative solutions, (d) organizations became more adept at managing change after deploying innovative supply chain solutions, and (e) improving the customer experience was an important consideration that aided in the decision making to deploy an innovative supply chain solutions.

Presentation of the Findings

The guiding research question for this study was: What innovative supply chain strategies do manufacturing sector supply chain leaders use to achieve supply chain flexibility? For data triangulation, I conducted semistructured interviews with open-ended

questions (see Appendix C) and reviewed physical documents from the participating organizations. This section includes the participants' responses, emerging themes, and my conclusions. These areas supported answering the research question of this study. I compiled the findings and analyzed the collected data using NVivo. Using Yin's five-step thematic analysis, five themes emerged. I designated the participants with the coded alphanumeric numbering of SCL1, SCL2, SCL3, SCL4, and SCL5.

In the following subsections, I discuss each theme as well as how the theme aligns with the literature and conceptual framework of BPR. This model was chosen because its focus on how redesigning organizational processes can improve organizational performance. BPR is centered on technology and process improvement, which both drive innovative change within an organization (Goksoy et al., 2012).

Theme 1: Technology

Supply chain leaders evaluate technological solutions to help innovate the organization's supply chain (Dobson & Chakraborty, 2020; Parast, 2020) All five participants agreed that technology aided in innovating organizational supply chains. However, the technology solutions varied, from software applications implementation to implementing ERP/WMS systems. Other technology solutions ranged from radio frequency identification deployment to providing real-time visibility, robotics that allowed for automation of the pick/pack processes, and software packages to streamline existing manual processes.

All five participants (100%) stated that they either purchased or had plans to buy or upgrade their ERP systems or added the WMS module to create greater visibility into

their organization's supply chains. SCL2 noted that their older ERP system did not have the needed capabilities as their organization grew. When the stakeholders decided that they needed an ERP system that provided enhanced visibility and they finally upgraded, it made a big difference in providing additional visibility into different processes. In addition, it enhanced the quality control processes of the parts they manufacture. SCL3 stated that "we know that we need a new ERP system and have for several years, the most significant limitations for us are the cost of investment and the training of the employees using it." SCL4 shared, "we had been early adopters of an ERP system and integrating it into our supply chain management for many years. It has allowed the organization to take a systematic data-driven approach to evaluating our supply chain." SCL4 went on to state "that the investment at the time allowed us to grow with the ERP system and the ERP system to grow with us" and "as supply chain complexity grew, we grew as well." SCL5 shared that "once we had our initial TMS system we knew we had the foundation to build on" and that implementation and subsequent upgrades to their ERP/WMS system allowed the organization to build on its foundation and transition to other technological solutions that further innovated the organizational supply chain. As a result, ERP/WMS systems enable supply chain leaders to enhance and innovate the organization's supply chains (Forslund & Jonsson, 2010; Rouhani & Mehri, 2018).

Other technological solutions that the participants emphasized were not as labor intensive or robust as the deployment or implementation of ERP/WMS systems. Four of the five participants (80%) stated that using existing software to understand and better analyze data that the respective organization's supply chain function already had allowed

for a better understanding of where supply chain leaders could improve current deficiencies. When supply chain leaders can identify and correct inefficient processes, it can benefit the organization (Dobson & Chakraborty, 2020; Lyu et al., 2020). Training the existing workforce or recruiting talent in data analysis is an area that could strengthen the organization. Data analysis is important to identify the areas of the supply chain where innovation may be of benefit. Data analysis was highlighted by four of the five participants (80%) as an area of focus to better aid in the identification of areas of the supply chain that need improvement. Understanding how to mine the data and sift through the output is critical to identify potential target areas and to monitor the impact the deployed innovative solution(s) are having on the supply chain.

Relevancy to the Conceptual Framework

Davenport and Short (1990) stated that process redesign focusing on the development of technological solutions was a focus of BPR. BPR can be used by organizational leaders to innovate supply chains, and the research supports that technology is an important part of supply chain innovation. All the participants not only agreed that technology solutions were critical to innovating organizational supply chains, but they had also successfully deployed technology-driven solutions that innovated organizational supply chains. BPR is a tool that allows organizational leaders to evaluate changes through a different lens that will aid in driving innovative change (Goksoy et al., 2012).

Correlation to the Literature

The first theme that emerged from data analysis was that technology was critical to supply chain innovation. SCL5 stated that, "We knew that we had to go on a technology journey in order to improve our supply chain and we started to do that." When looking at the literature and the technology that is used to innovate supply chains, several areas were highlighted by the participants, but two stood out. ERP and WMS systems were present in every organization and used to improve supply chain processes. The implementation of an ERP system allows for information, such as inventory specifics, cost, product visibility, and order specifics, to be shared with finance, sales, operational excellence, and customer service, which streamlines processes and enables more timely decisions (De Soete, 2016; Zhu et al., 2008). It is important to note that based on the literature and the participants' responses that the time to deploy and expense of implementation of ERP systems may be a deterrent.

A WMS, which is a separate module for an ERP system, is dedicated to monitoring different warehouse processes, including goods and information flows, employee tasks, and warehouse operations (Baruffaldi et al., 2019). The implementation of a WMS allows supply chain leaders to innovate the organization's supply chains (Rouhani & Mehri, 2018). As supply chains have increased in size and complexity and warehouses have become a more integral part of the inventory storage and management process, having the total visibility that a WMS can provide can be critical to the innovation of organizational supply chains (Tejesh & Neeraja, 2018).

Table 1 shows participant responses related to technology in Questions 1, 2, 3, 4, 5, and 6. In addition, Table 1 shows that 29 references exist from the participant responses that demonstrate that technology solutions play a role when an organization is attempting to innovate its organizational supply chain.

Table 1

Technology Solutions in Supply Chain Innovation (Frequency)

Participant	Interview questions	Total number of references
SCL 1	1, 2	3
SCL 2	1, 2	3
SCL 3	1	5
SCL 4	1	7
SCL 5	1, 2, 3	11

Theme 2: Financial Impact

Organizational supply chain leaders need to evaluate the financial impact of implementing an innovative supply chain solution before deployment (Dobson & Chakraborty, 2020). After analyzing the participant responses, I found that the supply chain leaders defined economic implications differently. The first was as the initial investment expense of the innovative solution. Four of the five participants (80%) stated that it was essential to evaluate the cost of the innovative supply chain solution(s). Given that the evaluated organizations were midsized manufacturing firms, the initial expense could be substantial even though it was considered an investment. The cost was not always associated with the solution's price, such as an ERP system, automated

equipment, or a warehouse redesign project. Time to train employees, the potential of reduced production until the full deployment of the solution, or the possibility of the expense of the projected deployment taking longer than initially planned were also factors. Deciding when a project was a financial liability was also important to consider. Participant SCL3 commented that, "we didn't have the right people to force an ERP system through" and given it was "a major investment, we held off." SCL4 provided an example where an innovative solution was installed, but "the productivity increases that were supposed to result from the solution just weren't there." These are both examples where solutions were started but the projects did not yield the projected returns, and given the unfavorable financial ramifications, it was determined to end the project and go in a different direction. SCL4 commented that innovative solutions have come down in cost and are scalable, making them easier to evaluate and implement from a solution perspective and that "…companies should do something with innovation as there are opportunities."

The second financial consideration was the return on investment (ROI) required for implementing ERP. The participants determined the potential cost savings that the innovative supply chain solution would enhance. For example, three of the five interview participants (60%) discussed reducing staff hours as a direct factor in the ROI. The length of the expected ROI differed based on the scope of the innovation deployed, but the supply chain leaders expected returns immediately after the completion of the project. As mentioned previously, time to train the employees on new systems or processes is an expense, but this also is a ROI. Deployment of an innovative solution should have a

defined ROI stated SCL4, who continued to say that even though they have an expected ROI, organizational leaders should not limit themselves to the minimum expected return. SCL5 commented, “ROI is more than just cost savings, it is also how the innovation contributed to growth.”

Organizational leaders can measure ROI in more ways than traditional supply chain metrics, such as pick and pack efficiency, delivery lead times, on time performance or manufactured product defects. The growth and competitive advantage that the organizations benefit from are also areas where ROI can be evaluated. SCL3, SCL4 and SCL5 shared that the solutions they had deployed allowed them to differentiate their organizations and the products they manufacture from their competitors. ROI can also be measured in an organization’s ability to adjust to supply chain disruptions. Supply chain mitigation allows for a faster reaction to challenges that may arise, and the ability to respond to changes more quickly can mean a reduction in lost sales, the identification of new opportunities, or the ability to change the sourcing of parts or materials needed to continue to service customers.

Relevancy to the Conceptual Framework

Cost reduction is an area that BPR specifically addresses. Organizations improve when deploying an innovation supply chain solution. Worker productivity and efficiency can be improved when using BPR (Zhilyaev et al., 2018), and the analysis of processes that could be enhanced and improve an organization’s supply chain are one of the first steps of the BPS process (Kruger, 2017). These steps not only help identify areas needing improvement, but once the areas have been improved, they have a positive impact on

savings within the organization. The data demonstrated that cost reduction and the ROI from an innovating solution were areas that were evaluated by supply chain leaders.

Correlation to the Literature

The second theme that emerged was that financial impact was an important consideration when looking to implement an innovative supply chain solution. While I did not identify this as a specific area that should be highlighted in the literature review, innovative solutions are deployed to make processes more efficient, improve employee productivity, or increase output. All these items have a direct impact on profitability. If an organization has a supply chain that is not running efficiently, it can impact long-term profitability (Roh et al., 2014).

Table 2 shows the frequency of participant responses related to financial impact in Questions 1, 2, 3, 4, 5, and 6. In addition, Table 2 shows that there were 44 references in the participant responses that demonstrate that financial impact was evaluated from two different perspectives when they attempted to innovate organizational supply chains.

Table 2

Financial Impact in Supply Chain Innovation (Frequency)

Participant	Interview questions	Total number of references
SCL 1	1, 2	9
SCL 2	1, 2, 3, 4, 5	11
SCL 3	1, 2, 3	6
SCL 4	1, 2, 3, 4, 6	10
SCL 5	3, 4	8

Theme 3: Cross-Functional Collaboration

Supply chain innovation is the responsibility of all departments and functions (Solaimani & van der Veen, 2021). Four of the five (80%) participants stated that collaborative efforts across the organization improved due to the evaluation or implementation of innovative supply chain solutions. Collaboration across multiple departments strengthens the organization (Lee & Kim, 2019). It may be easy to overlook cross-functional collaboration when evaluating supply chain innovation given that most organizations have a dedicated department or function that oversees supply chain activities. Many of the participants did not feel that was the case, with 80% reporting that collaborative efforts, whether preexisting or not, improved while evaluating or implementing supply chain innovation that best benefitted the organization. SCL3 shared that cross-functional collaborative efforts always existed, but cross-functional involvement improved as supply chain leaders started to consider or deploy innovation in the supply chain. SCL3 also discussed how overseeing different departments "allowed me to see different issues and bring different perspectives," which created more idea sharing across the organization and encouraged employee rotation from one function to another. Such rotations will often give a broader perspective of the organization and allow for best practices to be shared. SCL3 also mentioned that rotations in the department created an environment of creativity and a better understanding of the entire supply chain process. SCL1 shared, "We had developed and used an innovative solution in one function that had yielded results and it was adopted in another department." This is an example of where other functions adopted some of the processes used to innovate the

supply chain because it also improved the functional processes of those respective departments. SCL5 shared that as they exposed more staff to the different facets of the organization, there was more collaboration that allowed for a better evaluation of the critical supply chain innovative solutions. Lastly, three of the five participants (60%) felt that cross-functional collaboration drove organizational improvement by the different departments or functions challenging each other to drive organizational excellence.

Relevancy to the Conceptual Framework

While cross-functional collaboration was not specifically mentioned in the conceptual framework of BPR, it was noted that BPR impacts multiple functions, it affects the function it directly supports, and the additional functions influenced by the process (Goksoy et al., 2012). It is also worthy to note that BPR requires evaluation of organizational processes to determine which are inefficient and should be updated and replaced and for organizational leadership to ascertain which processes should be targeted that all functions or departments should be involved. In some instances, reduction or consolidation of functions or departments may be a result of the evaluation process as well, and that would require cross-functional involvement.

Correlation to the Literature

The third theme that emerged from my research was that cross functional collaboration as it relates to supply chain innovation is the responsibility of all departments and functions (Solaimani & van der Veen, 2021). Eighty percent of the participants agreed that organizational collaborative efforts improved due to the evaluation or implementation of innovative supply chain solutions. Collaboration across

multiple departments strengthens the organization (Lee & Kim, 2019) and as the research correlates to the literature, SCM was an area where the literature heavily emphasized the importance of cross-functional collaboration given SCM is defined as the consolidation of business processes to include end-users, suppliers, and other stakeholders that bring additional value to customers and the organization (Anca, 2019; Min et al., 2019). SCM focuses on the many moving parts of an organization and how the evaluation and improvement of those moving parts will improve organizational supply chains. The literature supported the research that cross-functional collaboration is important to supply chain innovation.

Table 3 shows the frequency of participant responses related to cross-functional collaboration improvement in Questions 1, 2, 3, 4, 5, and 6. In addition, Table 3 shows that 24 references exist from the participant responses that demonstrate that collaboration improved when supply chain leaders attempt to innovate organizational supply chains.

Table 3

Cross-Functional Collaboration in Supply Chain Innovation (Frequency)

Participant	Interview questions	Total number of references
SCL 1	2, 3	3
SCL 2	1, 3, 5	5
SCL 3	2, 3, 4	6
SCL 4	2, 3, 4	6
SCL 5	2, 5	4

Theme 4: Change Management

Change management is the process where people or organizations adopt new strategies, processes, or ideologies to achieve desired outcomes (Mirzoyan & Tovmasyan, 2022). Change management is critical when looking to drive culture change within an organization (Dawson, 2020; Pryymak, 2019) and can improve overall organizational performance (Dawson, 2020). Barriers to organizations implementing change are often a result of resistance from employees to change given a comfort with existing processes or methodologies (Khan et al., 2017; Metz, 2021).

When innovative supply chain solutions were evaluated or implemented four of the five participants (80%) felt that the organization became better at managing change. Managing change centered around a few different areas, including employees, the organization becoming better and quicker at managing change due to repeated project implementation, changing the organizational culture of resisting change and more adept at navigating supplier and customer relationships.

When analyzing the participant's responses regarding change management as it relates to employees, the participant's responses were consistent that the success of any innovative supply chain change would be impacted by how the employees embraced the change. Employees may be resistant to change but educating the employees on why the change is happening and ensuring that they are adequately trained on the new technology, processes or systems will assist with the employee's attitude toward the change. SCL3 stated that as change occurs it is important to assess the talent you have in your current positions as the changes may not carry over to your current talent. Ensuring that you have

people in the correct positions and that they are adequately trained are critical to project success.

SCL3 stated, “innovation breeds itself.” The discussion centered around the implementation of different innovative projects and how quickly the employees and organizational stakeholders became more adept at implementing and adopting change. The more frequent that change is made and that the change is successfully navigated by management will determine how quickly organizational culture will shift producing desired organizational outcomes and management initiatives and goals. This flexibility provided by successful ERP implementation will not only help with the change management but will facilitate the proactive communication needed by stakeholders that demonstrates the organization is open to listening and embracing change. This will ensure that the organizations and their employees are not only prepared to better manage change they are willing to embrace it.

Four of the five participants (80%) shared that a barrier to adopting any innovative solution was change resistance. Employees and other stakeholders get accustomed to processes being done a certain way and when organizational change has been stagnant when change is suggested it can often be met with resistance. Four of the five participants (80%) shared that the best recourse to assist with this mentality is to communicate and engage the proposed changes proactively. Gaining the buy in and ideation of the proposed solutions prior to implementation is critical to drive adoption and a successful implementation. SCL5 stated that it is important that you, “get past the previous culture of that’s the way we have always done it before” if you want to be

successful. Repeated innovative projects help with stagnancy as employees become more accustomed to change and understanding the benefits of why change is happening will aid in driving success. Collaboration across the organization and other stakeholders such as suppliers and customers will also aid in successful supply chain project implementation. The goal is to change organizational culture that change can be beneficial to an organization's success.

Supply chain projects aid with managing supplier and customer relationships as they force the organization's employees to look at the supply chain through a different lens. This is important as it helps the organizations, and the employees better understand how the innovative solution will impact all parties and why it is important. Organizations must be willing to change with the suppliers they work with and the customers that they support. This can be a competitive advantage and drive ideation across all the stakeholders. Actively communicating the solutions and how they can be supported will drive further ideation from the stakeholders. When all parties contribute to the project the likelihood for success increases.

Relevancy to the Conceptual Framework

BPR is focused on driving innovative change within organizations. The research demonstrated that supply chain innovation is influenced by how organizational culture and the employees themselves are willing to accept and embrace change. Change management is how organizations adopt and implement new processes to achieve desired outcomes (Mirzoyan & Tovmasyan, 2022). Four of the five participants (80%) felt that when organizations evaluated or implemented an innovative change that the organization

would be better able to manage change in the future. This change was not focused on innovation alone, but also impacted relationships with employees, vendors, customers, or other stakeholders. BPR and the research collected demonstrated relevancy to each other.

Correlation to the Literature

Organizational challenge was an area that was identified in the literature review that had a direct correlation to change management. Fonseca and Domingues (2017) noted that organizations are continually challenged by external and internal influences. Eighty percent of the participants agreed that a barrier to implementing an innovative solution was internal resistance. Supply chains are in a constant state of flux and due to that challenges are arising continuously. How organizational leaders handle and prepare the stakeholders for that change will determine how successful changes such as supply chain innovative solutions will be. The literature and the research gathered supported that change management is an area that will impact the success of supply chain innovation.

Table 4 shows the frequency of participant responses related to change management in Questions 1, 2, 3, 4, 5, and 6. In addition, Table 4 shows that 41 references exist from the participant responses that demonstrate that collaboration improved when supply chain leaders attempt to innovate organizational supply chains.

Table 4

Change Management in Supply Chain Innovation (Frequency)

Participant	Interview questions	Total number of references
SCL 1	2, 4	13
SCL 2	1, 2, 4	6
SCL 3	2, 3, 4, 5	8
SCL 4	1, 2, 4, 5, 6	8
SCL 5	2, 3, 4, 5	6

Theme 5: Customer Experience

Four of the five (80%) interview participants stated that the impact on the customer, whether to enhance the customer experience or attract new customers or business was a something to consider when evaluating a change in the supply chain. Organizational supply chains can be a competitive advantage (Zimmerman et al., 2020). SCL2 and SCL5 noted that customers are not always the end customer but can be distributors or suppliers. Supply chains can weaken or strengthen the customer relationship (Israel, 2022). SCL4 stated "We actually bring our customers in and show them how we process their orders" as it takes them through the various steps of the order fulfillment process. The tour focuses on service and quality, and the organization views these processes as investments into the organization's ability to differentiate itself from its competitors. When deploying an innovative supply chain solution, the impact to the customer may not be the sole focus, but when analyzing the solution, the likelihood that the customer is going to benefit exists. SCL1 reviewed a supply chain issue where they

were losing visibility of reusable containers and had to purchase replacements. This was causing a situation where the budget was being exceeded. As the supply chain function deployed an innovative technology-based solution they realized that the visibility also enhanced the customer experience. It made the containers readily available to ship product to the customers thus reducing the wait time and it also facilitated more proactive communication.

Four of the participants (80%) stated that the supply chain solutions they had implemented aided in improving the customer experience by directly impacting the fulfillment and shipping of product. SCL3, SCL4 and SCL5 said that their organizations were able to service the customer timelier than they had previously by knowing what product was on stock, when their customers needed it and how long it would take to get their orders to the customer. SCL2 stated that the ability to pick and pack and accurately package customer orders made that process one that improved how their customers viewed the logistics function.

Relevancy to the Conceptual Framework

Customer experience directly relates to BPR because the areas of service and competition are specific metrics that are targeted (Goksoy et al., 2012). Quality is also an area that BPR impacts and when customers receive a better-quality product or service their experience is improved. Evaluating the competition is an indirect focus of BPR as it helps determine which areas organizational leaders should focus on for improvement. During the data collection process SCL3 shared, “We actually order, inspect and evaluate the competitor’s products” to determine how our products and packaging can be

differentiated. The main objective of BPR is to improve areas that impact quality and dependability, which are supported by the research.

Correlation to the Literature

Customer experience was not a direct focus of the literature but was emphasized in several of the targeted sections. The sections of SCM (improve competitiveness), supply chains and innovation (listening to customers), organizational challenges (competitive differentiation), and innovation driving competitiveness (competitive advantage) all emphasized the importance of evaluating how supply chain innovation could positively impact the customer. Eighty percent of the participants shared that improving the experience of existing customers or the attraction of new customers was a determining factor when evaluating an innovative supply chain solution. All the participants also agreed that deployed innovative solutions directly impacted the customer's experience. The collected data from the participant interviews supported the collection and review of the academic literature.

Table 5 shows the frequency of participant responses related to customer experience improvement in Questions 1, 2, 3, 4, 5, and 6. In addition, Table 5 shows that 37 references exist from the participant responses that demonstrate that collaboration improved when supply chain leaders attempt to innovate organizational supply chains.

Table 5

Customer Experience in Supply Chain Innovation (Frequency)

Participant	Interview questions	Total number of references
SCL 1	1	1
SCL 2	1, 2, 3, 5	7
SCL 3	1, 2, 3, 4	9
SCL 4	3, 4, 5	11
SCL 5	1, 2, 3	9

Applications to Professional Practice

The findings of this study may assist supply chain leaders within manufacturing firms with innovative solutions that will increase supply chain flexibility. Increased flexibility will improve efficiency and profitability in organizational supply chains (Baruffaldi et al., 2019). Supply chain flexibility will also assist organizational leaders in mitigating supply chain challenges (Birkie & Trucco, 2020). Successfully navigating supply chain disruptions is a constantly growing priority for supply chain leaders (Baryannis et al., 2019) as supply chains are increasingly complex. Global commerce, technological advances, and increased consumer demand drive this added complexity.

Organizations implementing an innovative supply chain solution may benefit from a competitive advantage (Aryal et al., 2020; Ben-Daya et al., 2019). Areas of competitive positioning could include new technologies that enhance the customer experience by providing additional product visibility within the supply chain, a process or system enhancement that improves the order accuracy or reduces the production rate of

defective components. Regardless of the innovative solution used to gain a competitive advantage, if the purchaser of the product is happy with the experience, it creates a competitive differentiation that will benefit the organization (Jugovic et al., 2019; Partida, 2018).

The study participants are supply chain leaders with experience deploying successful innovative supply chain strategies. The participants emphasized that supply chain leaders constantly evaluate their supply chains for innovative opportunities to create areas for the organizations to flourish and remain competitive. Innovation adaptation takes time, and the participants indicated that they felt organizational culture impacted the success of the innovative solution deployment. Engaging employees throughout the stages of innovation deployment was critical to the project's success. Organizational leaders stated to expect some risk, and that failure may occur at some point, but that should not deter the ongoing evaluation of potential innovative solutions.

Supply chain leaders' ability to assess areas of opportunities that improve innovation in supply chains will impact overall organizational effectiveness. Identifying the location needing improvement that the innovation will target is one of the most important steps of the process. The subsequent innovative solution deployed should be beneficial to multiple supply chain processes. All the participants agreed that technology aided in areas of opportunity and that financial impact to the organization was a significant consideration of the innovation to be deployed. The impact of the innovative solution on customer experience is also important to consider. Lastly, managing the potential resistance to change was a challenge that organizational leaders had to evaluate.

Implications for Social Change

Organizations may use innovative practices to improve efficiency and improve upon profit margins to create additional employment opportunities (Belloc, 2022). Additional employment opportunities may also be created by the need for employees proficient in ERP systems, data analytics, or technology integration (Desjardins, 2019). Competitiveness may benefit from streamlined efficiencies that enhance the customer experience by reducing product defects and improving order fulfillment quality which may positively impact the customer's healthy and safety with some products (He et al., 2018; Madar, 2020; van Wingerden et al., 2019) and the time it takes to fulfill the customer's orders (Tian et al., 2018).

Sustainability in manufacturing may impact on society by reducing the carbon footprint. Reduction in energy consumption from streamlining processes such as improved production, consolidation of shipments to ship less, reduction of corrugate consumption, and reduction of needed warehouse space (Nantee & Sureeyatanapas, 2021). By improving the order efficiency and visibility of products in the warehouse, pick and pack efficiency and order quality will improve. This will mean less returns or reverse logistics expense as the packages will not be sent back to the shipper. This will mean better trailer or container utilization reducing unnecessary movements and storage of the returned product, improving sustainability initiatives such as fuel reduction, wear and tear on the transportation infrastructure, and reduced carbon emissions (Rebelo et al., 2021).

Recommendations for Action

Leaders in manufacturing will benefit from the deployment of supply chain innovation by increased efficiencies throughout the supply chain function (Nantee & Sureeyatanapas, 2021). Improved efficiencies in order fulfillment, pick and pack processes, reduction of inventory, visibility of product on hand and improved quality control will aid with warehouse management practices (Rebelo et al., 2021). The use of data analytics can assist supply chain leaders adjust more quickly with supply chain management decisions. This can impact the overall competitiveness and economic stability of the organization (Nantee & Sureeyatanapas, 2021; Rebelo et al., 2021). The results of my study may provide manufacturing supply chain leaders with the means to drive increased efficiency not just withing the organization's supply chain but improve overall organizational competitiveness and aid with sustainable growth. Based on my research findings I would recommend the following:

- Supply chain leaders evaluate innovation opportunities within their organizations that can positively impact the efficiency, profitability, and competitiveness of the organization.
- Supply chain leaders seek input from the employees and other stakeholders to improve the probability of the innovative solution being deployed successfully.
- The evaluation of the deployed innovation must be frequent to ensure that the solution is providing a positive ROI. If it is not, moving on quickly to prevent additional risk will be critical to organizational success.

- Supply chain leaders must be cognizant of the organizational culture when evaluating and deploying an innovative solution. Failure to do so may impact the success of the deployed solution.
- Leaders must invest in analytics analysis to identify areas that should be targeted for innovation as well as the post analysis to determine if the innovative solution is driving the results it was intended to.

The purpose of this study was to explore innovative solutions that supply chain leaders would use to improve efficiencies withing their organizations. The findings in this study are essential for supply chain leaders to evaluate their supply chain processes, how technology can be leveraged to assist with pinch points in the supply chain process, how to engage employees as the innovative solutions are evaluated and deployed, and lastly, how to overcome organizational culture that may limit the adoption of innovative supply chain solutions that could improve organizational results and competitiveness.

Recommendations for Further Research

In this qualitative multiple case study, I explored how supply chain leaders in manufacturing successfully deployed innovative supply chain solutions. The research may assist manufacturing supply chain leaders with opportunities to improve their supply chains in different capacities. Supply chain innovation can have a positive impact on organizational performance (Huang & Yang, 2014; Rebelo et al., 2021). When researching supply chain innovation in manufacturing there was limited research on that specific area, so broadening the individual areas and how they related to manufacturing

was necessary. Given the available research, supply chain innovation in manufacturing will require further study.

Limitations in this study included the sample size. The sample size was not reflective of all supply chain leaders that have deployed supply chain innovation solutions given I used five participants. Further research may include a larger sample size or include supply chain leaders in other areas of manufacturing or other industries. The research, while focused on manufacturing may also be valuable to other industries or others than those in supply chain positions. Supply chain innovation can benefit multiple industries (Rampersad et al., 2019)

Future areas of research may include the impact of detailed data analytics within the supply chain to redesign supply chain networks. The availability of real-time data may allow for more nimble and agile opportunities to make more effective and quicker decisions. One of the interview participants mentioned that having a "digital twin" or using a "living model" with real-time data would allow for a more predictive approach to SCM. Using could completely disrupt how organizations approach supply chain mitigation strategies.

Reflections

The completion of my doctorate research was a journey. It was challenging but enriching both personally and professionally. I conducted a qualitative, multiple case study to understand better what innovative supply chain strategies supply chain leaders in manufacturing organizations use to achieve supply chain flexibility. I related with the participants, who all agreed that implementing innovation in the organization's supply

chain yielded benefits. I realized that innovative solutions that supply chain leaders implement are often aided with some sort of technological solution but the technology, and how it is used varies considerably. I also realized that the financial impact that an innovative solution will have on the supply chain and the organization is something that is evaluated by supply chain leaders. This includes the expense of the solution, the return on investment that can be expected from the solution and how quickly the return can be realized. My research also highlighted that how supply chain leaders manage and communicate change can impact the success of innovative solution deployment. This communication is inclusive of organizational employees and stakeholders that will be impacted by the innovative solution. Lastly, the participants emphasized how the customer will be impacted is large factor when evaluating and choosing which supply chain innovative solution will be deployed. During the research process and the participant interviews I was careful to not my experiences influence any bias. I asked the questions from a neutral perspective to ensure to not influence the participants responses.

Throughout the research process to better understand how manufacturing supply chain leaders deployed innovative solutions I ensured that the process was designed to remain bias free. I obtained consent, asked open-ended questions, transcribed the responses, and then had the participants validate their responses. The doctoral research process of determining which methodology and design to choose, which conceptual framework to align with and how to conduct and apply the professional and academic literature was rewarding and allowed me to grow academically. The undertaking of being a doctoral student, working full time, and maintaining a family life takes dedication and

commitment. Completing my doctoral study took sacrifice but also allowed me to better understand how supply chain innovation can positively impact an organization and how supply chain leaders evaluate and execute innovative solutions.

Conclusion

The focus of my study was to research the innovative supply chain strategies that supply chain leaders in manufacturing organizations use to achieve supply chain flexibility. I chose a qualitative, multiple case study with open-ended questions to determine what solutions supply chain leaders have successfully deployed that have improved profitability and increased efficiency. Supply chain leaders that deploy innovative solutions within their organization can positively impact their organization's quality, improve production, increase efficiency, and reduce costs (Baruffaldi et al., 2019; De Soete, 2016; Riley et al., 2020). My research demonstrated that supply chain leaders may use the principles of BPR conceptual framework to develop innovative strategies to improve supply chain flexibility.

For my study I created six open-ended interview questions to collect responses from the participants to determine their experience at deploying innovative supply chain solutions. I used purposive sampling to choose my participants that were supply chain decision makers in manufacturing organizations that had successfully deployed an innovative supply chain solution. I transcribed, coded, and analyzed the interview data using NVIVO software to process and organize the information that I collected. After coding the data five themes emerged that supply chain leaders looking to deploy innovative supply chain solutions may find beneficial.

The research question for this study was: What innovative supply chain strategies do manufacturing sector supply chain leaders use to achieve supply chain flexibility? The results of the research yielded five notable themes: (a) technology aids supply chain innovation, (b) financial impact is an important consideration, (c) cross-functional collaboration, (d) change management, and (e) customer experience. The themes supported the research question of what innovative strategies do supply chain leaders use to achieve supply chain flexibility.

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Appendix: Interview Protocol

Participants will be emailed a copy of the informed consent form establishing their willingness to participate as an uncompensated volunteer. Participants will be given three days to review the consent form and decide if they are willing to participate. If they are willing to participate, they will respond to the email acknowledging as such.

The following steps outline the interview protocols:

1) Send each participant an invitation letter with options to choose their preferred time to participate in a face-to-face or remote video interview.
2) Before starting the interview, I will remind the participants that their participation is voluntary and not compensated. I will provide all participants with a copy of my doctoral study as a thank you for their participation.
3) I will remind the participants that they can withdraw from the study at any point of the process by emailing or calling me, even after the data collection.
4) I will provide the participants with my contact information to contact me if they wish to withdraw from the study.
5) I will ensure that I have a signed consent form (Appendix A) from the participant before starting the interview.
6) I will ensure that the participants have a copy of the signed consent form (Appendix A).
7) Before starting the interview, ask the participant for permission to begin the audio and video recording.

8) I will record the interview using the pre-determined interview questions (Appendix C). The questions will be opened-ended to ensure that the questions are answered thoroughly and completely.
9) After the interview, I will remind the participants that their organizations' responses, identities, and identities will be kept confidential.
10) After the interview, I will remind the participants that I will provide a copy of the interview summary to ensure that my interpretations of their answers are accurate and ask them for validation of such.
11) I will conclude the interview and thank the participant for their willingness to be a part of the information-gathering process.